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The Magazine of New Energy Science and Technology

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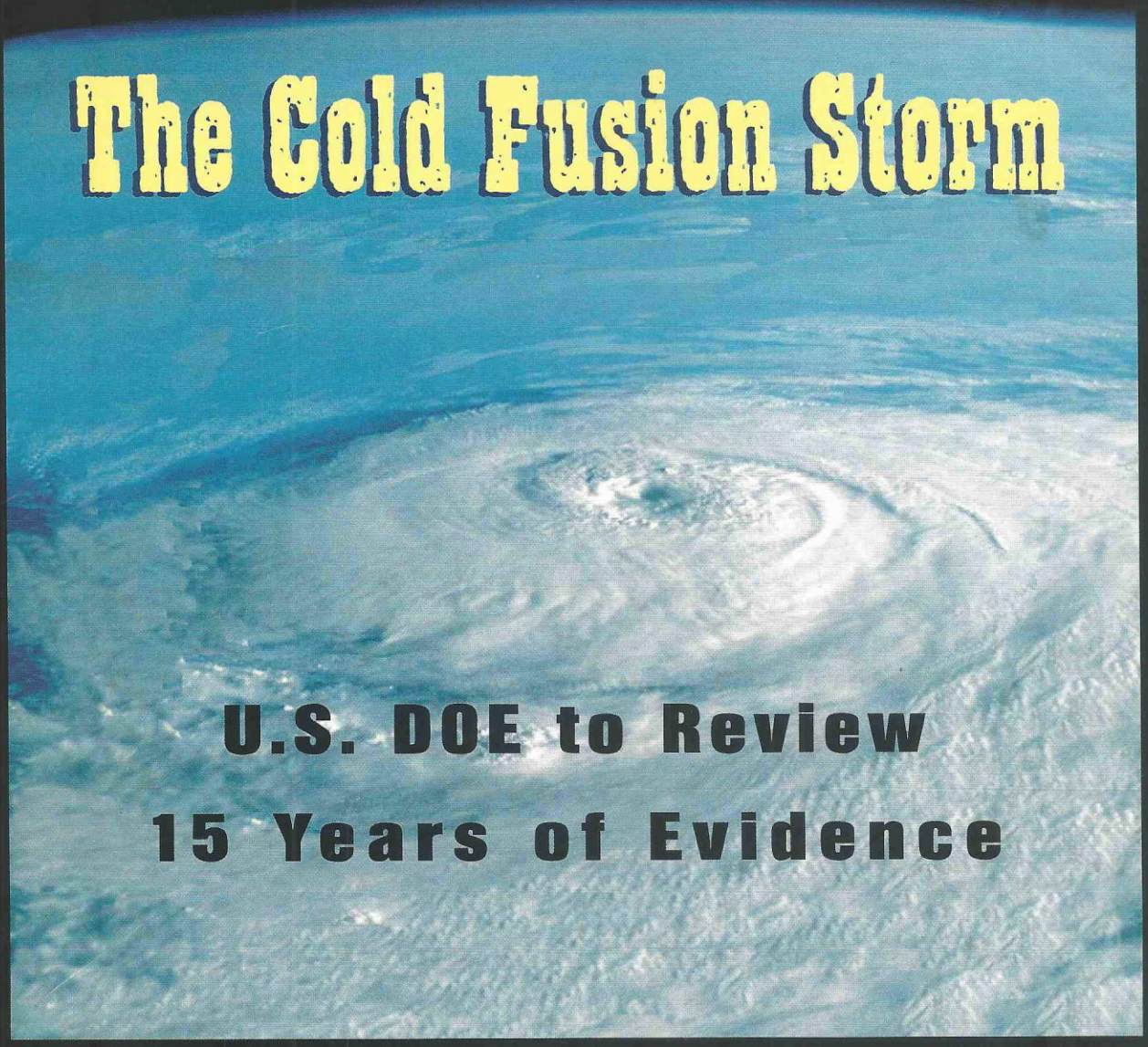

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U.S. DOE to Review 15 Years of Evidence

Hydrogen Fuel Cells:

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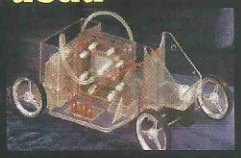

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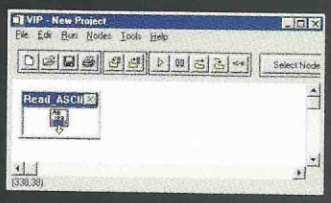

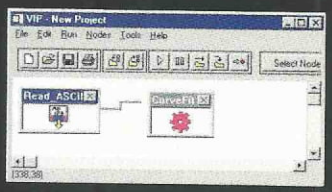

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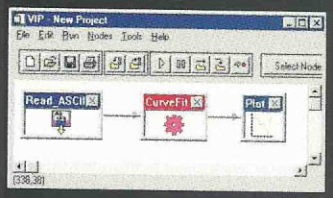

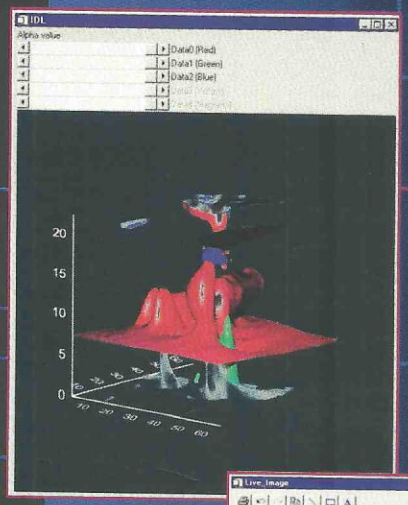

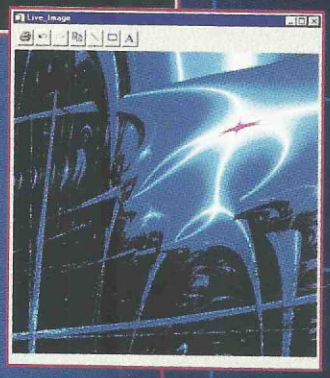

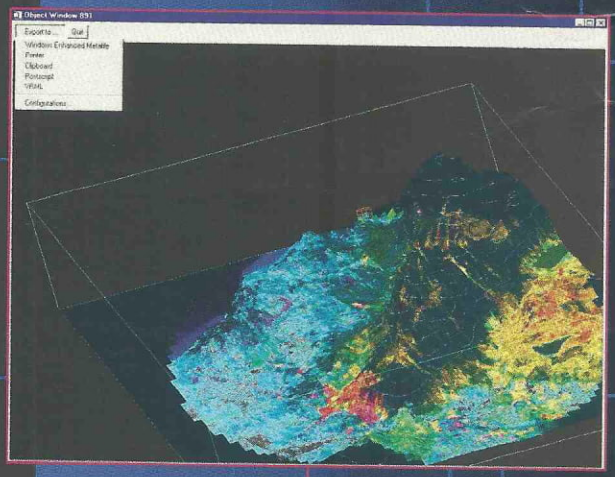

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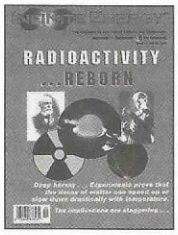

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concentrator. However, the aiming accuracy would have to be much higher than presently possible."

Though these extraordinary space-based developments could be implemented in the future, we need not wait for them for solar energy to make a huge difference on our planet, the inventors say. Implementation of the technology right here on Earth is essentially resource limited. The needed components already exist in other fields. At this stage, it is hard to say how quickly this badly needed technology could be implemented. Rabinowitz said, "If you live by the crystal ball, you should be prepared to encounter broken glass. Rather than make predictions, let me outline a reasonable course of action.

1. The simplest thing to do first would be manufacture a passive solar concentrator based upon our invention to enhance the performance of the solar photovoltaic converters that already exist on the rooftops of millions of homes. It should be possible to easily increase the output by a factor of 4 in this way for the majority of homes, without the necessity of adding cooling to the converters.
2. The next easiest thing would be to introduce single axis tracking of the sun for new installations.
3. The next step would be to introduce two axis tracking of the sun for industrial applications.
4. After that, we could think about solar farms. A total aggregate area of less than 4,000 square miles in the Southwest could supply the entire peak power needs of the U.S. of 1 Terawatt (10^{12} Watts). A square of only 63.25 miles on a side encompasses 4,000 square miles. Of course it would be desirable to have smaller units distributed across the country.
5. Solar residential and/or community-based solar energy conversion is a form of distributed power that decreases vulnerability to terrorism compared to present central large power generating plants. In general solar energy enhances the security of the energy supply since it is a natural resource not confined to national borders.

"Of course, we would need to think about new ways for conversion of dc to ac. I have ideas about ways for doing this. Or alternatively dc appliances could be introduced for lighting, cooking, heating, cooling, etc. When electricity was first commercially introduced, it was dc. There was quite a battle to change it to ac. The winner was ac, largely because of the ease with which it could be transformed to high voltage for transmission; and then transformed to low voltage for distribution. Solar power could obviate the need for high voltage transmission. There could ultimately be a resurgence to dc. But in the meantime, we can find better ways to make ac from solar energy.

"Presently, solar energy is a factor of 2 to 3 from being competitive with other energy sources. With just our Mini-Optics Solar Energy Concentrator invention working at a modest factor of 10x concentration, solar energy could be less expensive for peak power demand than other energy sources by a factor of 3 to 5."

U.S. Patent #6,612,705 B1
Mini-Optics Solar Energy Concentrator
Inventors: Mark Davidson and Mario Rabinowitz

Abstract:
This invention deals with the broad general concept for focussing light. A mini-optics tracking and focussing system is presented for solar power conversion that ranges from an individual's portable system to solar conversion of electrical power that can be used in large scale power plants for environmentally clean energy. It can be rolled up, transported, and attached to existing man-made, or natural, structures. It allows the solar energy conversion system to be low in capital cost and inexpensive to install, as it can be attached to existing structures since it does not require the construction of a superstructure of its own. This novel system is uniquely distinct and different from other solar tracking and focussing processes allowing it to be more economical and practical. Furthermore, in its capacity as a power producer, it can be utilized with far greater safety, simplicity, economy, and efficiency in the conversion of solar energy.

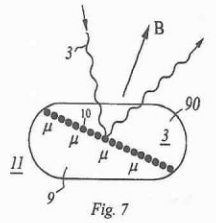

Fig. 7

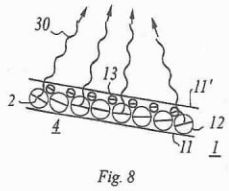

Fig. 8

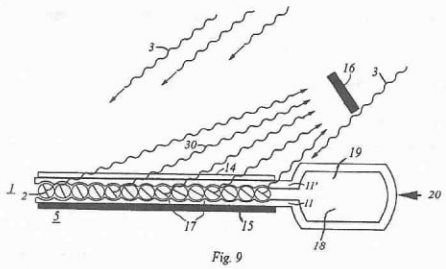

Fig. 9

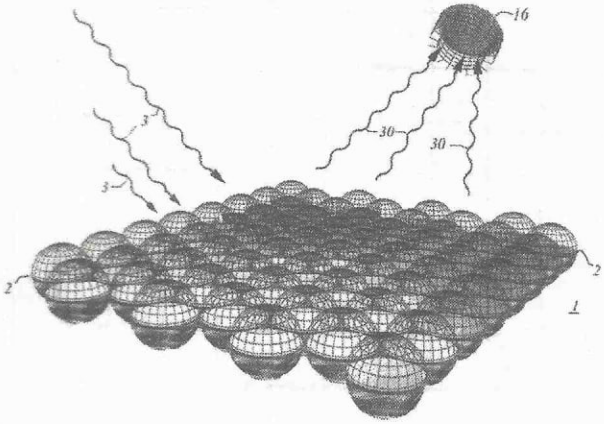

Fig. 10

MINI-OPTICS SOLAR ENERGY CONCENTRATOR

Compiled by *Infinite Energy* Staff

Due to an ever growing shortage of conventional energy sources, there is an increasingly intense interest in harnessing solar energy. A limiting factor in the utilization of solar energy is the high cost of energy converters such as photovoltaic cells. A new breakthrough invention, which was granted U.S. Patent #6,612,705 B1 (September 2, 2003), provides a low cost means for achieving affordable solar energy by greatly reducing the cost of solar concentrators which increase (concentrate) the solar energy incident on a solar energy converter. For example, for the purpose of generating electricity, a large area of expensive solar cells may be replaced by a small area of high-grade photovoltaic solar cells operating in conjunction with the inexpensive intelligent mini-optics of this invention. Thus this invention might contribute to the goal of achieving environmentally clean energy on a large enough scale to be competitive with conventional energy sources. Interestingly, this invention ultimately harnesses fusion energy, as that is what powers the sun.

The inventors are Mark Davidson of Palo Alto, California, and Mario Rabinowitz of Redwood City, California. Dr. Rabinowitz critically examined cold fusion/LENR theory in the early 1990s. He also has an interest in black hole radiation (see *IE* #25, "Beamed Black Hole Radiation: Cosmology and Ball Lightning Connected").

New technologies must accomplish at least three goals in order to have an impact on society. They must fill an important need, and must further be economically and technically viable. The Mini-Optics Solar Energy Concentrator invention achieves these three goals, according to the inventors.

They claim it is less expensive than conventional solar concentrators for two reasons. First, due to miniaturization, the amount of material needed for the optical system is much less. Second, because the mini-optics solar concentrator is light-weight and flexible, it can easily be attached to existing structures. This is a great economic advantage over all existing solar concentrators which require the construction of a separate structure to support them and heavy machinery to orient them to intercept and properly reflect sunlight onto a collector. Such separate structures must be able to survive gusts, windstorms, earthquakes, etc. The newly patented invention utilizes existing structures which are already capable of withstanding such inclement vicissitudes of nature. Since each reflector is in a tiny mirrored ball that is easily rotated, the orientation control is small and inexpensive.

The invention deals with the broad general concept for focussing light. This mini-optics tracking and focussing system for solar power conversion ranges from an individual's portable system to solar conversion of electrical power that can be used in large scale power plants for environmentally clean energy. It can be rolled up, transported, and attached to existing man-made, or natural structures. It allows the solar energy conversion system to be low in capital cost and inexpensive to install, as it can be attached to existing structures since it does not require the construction of a superstructure of its own. This novel system is distinct and different from other solar tracking and focussing processes allowing it to be more economical and practical. Furthermore, in its capacity as a power producer, it can be utilized with far greater safety, simplicity, economy, and efficiency in the conversion of solar energy.

One of the two inventors, Dr. Mario Rabinowitz said:

"New developments are not needed to implement our invention as it utilizes existing Display technology in this new Solar Energy setting. Our invention would not have been possible without the fantastic progress that has taken place in the Computer and Display technology fields. This allows our concentrator to have a form of intelligence and miniaturization that would not have been possible in the past. The time is right for it, and it is badly needed at this time. To paraphrase Isaac Newton, 'We saw further because we stood on the shoulders of giants, and it is a good thing that we could and that we did.'

"I came to this invention by way of the Dyson Sphere. To help in the Search for Extraterrestrial Intelligence (SETI), Freeman Dyson suggested that astronomers look for strong infra-red sources. His reasoning was that a very advanced civilization would harness a very large percentage of their star's power output by building a spherical shell around their star to collect much more energy than would just be incident on their planet. Astronomers would then only see the infra-red re-radiated from the shell and not the higher frequency visible radiation from the star. This suggestion started the field of infra-red astronomy.

"As far as I have been able to determine, Dyson never said how this energy would be transmitted to the planet where it would be needed. Neglecting the instability of such a shell, one possibility that occurred to me was to have the shell be an ellipsoid with the star at one focus and the planet at the other focus. That way all rays from the star would be reflected from the surface of the ellipsoid to the planet. But that would be overkill and probably result in meltdown on the planet. Other possibilities seemed cumbersome and inefficient, such as conversion of the solar radiation to microwaves transmitted to the planet, and converted again. I felt that there must be a simple mirror reflection scheme that would do it. Our invention fits the bill. Along the lines of the Dyson Sphere (but on a much smaller scale), our invention would permit satellites, or possibly even a moon reflector to safely beam solar energy to the earth using our

riers with different masses (as the Graneaus and we, with the aPAGD, have observed—in compliance with Aspden's Law of Electrodynamics).

To call all these distinct physical interactions "Vacor lumination" adds nothing useful, while in fact subtracting all that is specific and scientific to each of them.

9. It would have been much better for orgonometry had Reich reserved the term "Vacor lumination" solely to operationally designate the plasma glow which arises when Vacor tubes are employed as energy sources in his OR Motor, as reproduced by these authors.[5] Then, it would have denoted a specific instance when ambipolar radiation is directly contributed by the "vacuum state" inside those tubes, to accelerate *in situ* the luminating plasma (in the normal glow regime). And there would have been no need for the useless assumption that such ambipolar energy is accumulated inside those tubes. Moreover, what accumulates inside a Faraday cage or an ORAC, whether the apparatus is directly exposed to the Sun or buried in a dark, unheated basement, is not ambipolar radiation but the molecular latent heat that it generates.

10. Had Reich isolated the concept of "Vacor lumination" properly, as per #9 above, then one might understand the element that might indeed link various plasma discharges *in vacuo*: how the glow discharge, whether normal or abnormal, presents a changing photon frequency which is a function of Paschen's Law, and how this phenomenon can be explained by a direct, *in situ* varying contribution of ambipolar energy from the "vacuum state."[6]

11. More remarkably still, our studies of auto-electronically pulsed abnormal glow discharges have identified, for the first time, the contribution of the "vacuum state" to the anomalous acceleration of the electron plasma through so-called elastic collisions, and explained how this ties in with Aspden's model of an aether spin[7] sustaining the vortical organization of the plasma, and with our aetherometric model for the emission of ambipolar radiation from the "vacuum state," from the latent energy that underlies the local fabric of space and time.[6]

So, we would not be surprised if investigators like Haisch, Puthoff, or Rueda were to reject Nieborowski's—or even Reich's—observations with respect to micron evacuated tubes, their treatment with Faraday cages or ORACs, and the observed plasma luminations. And by the same token, we would hardly expect a Reichian to function as an effective judge or peer of experimental and analytical aetherometry. For Haisch *et al.* will likely notice the same errors we have pointed out (no exposure to ORACs is needed in order to observe the glows under varied conditions and by proximity with diverse sources, tubes in that pressure range permit plasma formation, there is an (admittedly unexplained) Paschen curve for their breakdown, a slowly leaking tube would present identical glow effects at lower breakdown voltages, etc.), just as Reichians by belief will preclude performing the right controls on the experimental observations (testing a greater number of tubes, learning the art of tube building and contaminant-cleaning, employing varying vacua to calibrate the breakdown voltages, checking the test bodies with electroscopes and measuring, at least, the potential of their electrostatic fields, etc.). The net result of this is that no real advance will be made by either side with respect to a scientific understanding of the dynamic aether, how it behaves differently from the electromagnetic "aether" of ZPF theories, how a component of its electrical manifestation is in effect what Reich meant by orgone, how the electric nature of this dynamic aether is massfree (noninertial) and ambipolar.

For, indeed, ambipolar energy does not accumulate inside ORACs, anymore than it accumulates inside evacuated tubes. It consists of a radiative electric field, sourced in the "vacuum state," that can be dynamically elicited by a variety of manipulations to make different and pointed contributions to distinct plasma-discharge regimes. If there is no space with zero temperature, and there is nonthermal, nonelectromagnetic energy everywhere in space (dark energy) that constantly regenerates the average temperature of space as being the one that corresponds to the cosmic microwave background radiation, the only reasonable explanation for both facts is that the moving energy lattice of space itself is capable of becoming an emitter of ambipolar radiation through some very fundamental processes still unknown to modern physics.[8]

But even here, in this ambipolar intervention of the "vacuum state," the observed lumination would remain, as always, simply and solely a plasma-lumination, the result of the deceleration of the massbound charges composing the plasmas, in particular the electron plasma.

Grasping these simple facts would do away with the many ghosts that presently haunt electromagnetic theory as much as they haunt uncritical reproductions of Reich's electrical manipulations of evacuated tubes. The advancement of science, its comprehension of massfree energy and a better grasp of the energetic structure of matter and its interactions with the aether, depend entirely upon sticking to facts and not fictions, myths, or ghosts. There is no such thing as an open mind that sticks to fictions.

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sures, with the very same manipulations. Nieborowski himself unwittingly confirms this fact when he reports similar lumination phenomena that he observed with ordinary commercial lamps (read his item #20). As we have shown for years in our laboratory, all these observations of glow production can be made even with ordinary fluorescent tubes. But we went further and observed them in tubes evacuated to micron and submicron pressures with a variety of residual gases: right after sealing them at the desired pressures—presto!—stimulation with a variety of electric sources (*e.g.* the knob of a moving charged electroscope, an electrostatically charged body, etc.) resulted in glow production, without any exposure to an "orgone accumulator"! The phenomenon is reproducible and its conditions controllable, and *none of the conditions require "incubating" the tubes inside orgone accumulators.*

Nieborowski's linchpin—"that it takes an additional precondition to effect lumination via excitation: the tube has to be charged in an ORAC"—is, therefore, *patently false.* No such precondition exists, it is just *an error due to nonsystematic observation and lack of proper controls.*

This simple fact suggests that what is at stake when observing such glow lumination in certain vacuum tubes has nothing to do, indeed, with the accumulation of some massfree energy inside these tubes which can be excited to directly generate light. Insisting that it does, as Reich prematurely did, and as Nieborowski repeats after him, has been one of the main reasons why physicists interested in studying the existence of orgone energy—qua ambipolar radiation—have stayed away from orgonometric theory and its interpretation of its own experimental approaches to the problem.

Moreover, from an experimentalist's viewpoint, the same simple fact also suggests that manufacturers of specialty tubes do not assure quality control—today any more than they did in Reich's time. One tube may be well cleaned for purposes of a breakdown at 1.5 kV at 0.5 micron pressure, another may not have been so well cleaned and presents evolution of contaminant gases shortly after being sealed, so its breakdown falls to 0.5 kV at a much greater positive pressure in the micron range. Or still, just as probably if not more so—as we ourselves found out—equally well cleaned tubes lose the vacuum because of a variety of other factors—the sealing operation is not carried out properly, or small cracks develop in critical joints, etc. Commercially available glass itself, such as Pyrex, can come with microporous imperfections that produce slow leaks. So the simple reason why one of a pair of tubes sealed at 0.5 micron may be working with, say, a 0.5 kV potential from a moving electrostatic (*i.e.* trapped) charge, while the other is "dead," is not that one was placed inside an ORAC and the other was not, but that *the active tube under the same operational conditions* (a given test potential, at a given distance, etc.) *had already lost some of its vacuum.* The very fact that tubes sealed at various pressures permit, for a variety of potentials, immediate observation of the same phenomena clinches the case of one of the most basic errors committed by Reich—and reproduced *in toto* by Nieborowski. Nieborowski himself should have concluded to this loss of vacuum from his point #23, where he observes discharges with lumination intensities in the "treated" tube that "looked like" the discharges of "a vacuum discharge at higher pressure," *i.e.* higher therefore than the nominal pressure at which the experimental tube had been sealed.

7. Thus, the observations made by Reich and reproduced in part by Nieborowski are easily explained by a better grasp of what is known to conventional science, and do not warrant one to "think" in terms of a glass vessel that contains orgone energy and has accumulated more of it. The electric aether effect, as Aspden has not ceased to point out, is the so-called inductive field effect—and effectively a moving charged body induces the propagation of such a field, when it itself is not moving because of an applied field. But the field effect is no more a property of living systems than it is one of massbound charge or matter. Ambipolar radiation transmitted to such an evacuated tube will make it glow because it will impart kinetic energy to the electron plasma whose formation it induces. Moving trapped massbound charges mimic the effect of ambipolar radiation. But no ambipolar radiation is trapped inside that vacuum tube. It does not accumulate there. What may accumulate there can only be the latent heat of the residual molecules before they are plasma-polarized. And the higher the vacuum, the less molecular latent heat will be available per tube.

8. These considerations bring us back to another problem of Reich's investigation into the electric properties of vacua and, unwittingly, of plasmas: that, apparently, he grouped, to the damnation of so many readers and experimenters, very distinct phenomena under the heading of "Vacor tube phenomena." The field-emission discharges one observes in bright-white pulsating plasmas, or the normal glow discharges obtained by applying a moving charged rod to an evacuated tube without any applied voltage, or the normal glow lumination obtained by proximity with an emitter of ambipolar radiation, or Reich's use of Vacor tubes to drive his OR Motor, are not the same physical phenomenon, nor can they be subsumed under the same rubric—certainly not by fiat or by gross similarities. This has been a terrible confusion that has led some Reichians to reduce our aPAGD work to some vague aspect of Vacor tubes, just as it leads Nieborowski to a nebulous interpretation of his observations of the effect of human bodies upon so-called vacuum tubes. And this confusion is to the detriment of any serious consideration of Reich's own case for a massfree energy having distinct electric and nonelectric properties.

Indeed, real unifications of scientific thought cannot proceed by edict-type identifications: they are syntheses, not confused identifications, not syncrisis. All electrical discharges deploy plasma formation, but the plasma regimes of these discharges and their physical mechanisms are specific and rather distinct. It would advance us nothing to just decide one fine day to call them all "Vacor phenomena."

The eliciting of a glow discharge by the application of a *moving* (true) electrostatic field or an induction coil to the periphery of a micron-to-submicron range vacuum tube are ordinary plasma phenomena—and this is so even if ordinary electromagnetism does not know the functions associated with the ambipolar radiation underlying all induction fields. That under certain conditions this manipulation sources field-emission is still a different phenomenon,[3] one that indeed can hardly be said to be ordinary when what confronts it are the existing quantum-mechanical explanations for field emission. Still, neither of these phenomena, whether ordinary or nonordinary (*i.e.* anomalous), may be confused with, or reduced to, vacuum-arc discharges that deploy cathode reaction forces from the electrodynamic interaction of self-ordering plasmas composed of charge-car-

3. Thirdly, what *indirectly generates* that light is the applied electric field. If the field is truly electrostatic (including immobility relative to the fixed tube), no lumination is observed. Nieborowski confirms this fact, in his point #10, when he reports cessation of glow discharge inside the tube when the comb "was at rest." But if the electrostatic field is made to move and mimic an electrodynamic field, then lumination *is* observed. This is the basis of the phenomenon of the Wiggle Wave reported by R. Hull and C. Yost, and previously observed by Reich and by us. Nieborowski's observations with the moving hands, fingers, moving charge combs, etc. prove this point, which we, too, have repeatedly observed—just as we have observed its proper negative control with immobile isolated charges placed in the periphery of such test tubes.

4. However, there are two distinct aspects to consider when the issue of the glow response to living beings—*e.g.* human bodies—is introduced into the present experimental context:
First, the human body is a source of ambipolar electric radiation, as we have shown experimentally with field-detectors designed for this purpose, and as an aetherometric analysis of Kirlian photography and its physical foundations indicates[1]; moreover, in the study of certain electrical interactions, the ambipolar field effect *becomes* significant at short distances from the body surface. This is why Nieborowski is confused when he states (in his point #10) that he has "seen other tubes that luminated spontaneously when the hand was at rest"—since, with the proper residual gas "fill" and at very close distances or at contact, the ambipolar field effect becomes apparent by sourcing a glow inside the tube. But as Nieborowski effectively knows nothing about ambipolar radiation, the real orgone, he remains unable to separate the ambipolar from the monopolar effects of the human body.

Secondly, the surface of the human body (or, more properly, every organ surface) is a *reservoir of massbound monopolar charges*, electrons in particular, and *accumulates these charges* all the better when it obtains them by friction with the ground on dry days, while the body is properly insulated.

These are two very different electrical aspects of living systems—their *massfree* ambipolar electrical field and their *massbound* electrostatic field. Thus, whereas (1) the ambipolar field is *partially* responsible for the *discharge* which living systems can exert upon an electroscope, whether charged positively or negatively,[1,2] it is (2) the electrostatic massbound *charge* of living systems which is entirely responsible for their ability to *charge* electroscopes—with negative charge *only*—in dry environments.

What Nieborowski is observing in his plasma-lumination experiments is essentially only the effects of the electrostatic component of the field of his test-subjects, along with its variations in time, the effect of its discharge into water, etc. There is nothing anomalous to any of this; proper understanding of electricity suffices. And none of it is sufficient, or necessary even, for establishing the existence of orgone energy. On the contrary, it does a great disservice to any scientific demonstration of the existence of orgone energy—precisely by permitting physicists familiar with electrical phenomena and steeped in electromagnetic theory or the ZPE model to laugh at the primary errors that underlie such confused identifications and leaps of faith.

If orgone is so willfully confused with the effects of electrostatic fields from monopolar charges—or any dynamic manipulation of these fields that mimics an electrodynamic field and induces electric fluctuations—then orgone has found *its third useless incarnation as a misnomer for massbound electricity*, or, even more specifically, for massbound *negative* electricity.

5. It follows from the preceding that all experiments conducted with insulated human subjects in dry atmospheres are experiments performed with bodies charged electrostatically to *negative* potentials of up to 15kV or more. This can be easily confirmed with calibrated high-voltage electroscopes—as we did back in the days when we reproduced Reich's original observations of these electrical interactions.

Now, it suffices for the electrostatic charges trapped on the hand *moving over* tubes evacuated in the micron range to have a potential of a few hundred volts, to observe the same phenomena of glow lumination that Reich reported, and others before him, like Crookes and Tesla. With properly tuned vacua, one can even employ this method to elicit field emission.[3] This was also apparently observed by Nieborowski, and corresponds to what he terms "scintillations."

We pointed out some of these facts regarding the effects of the electrostatic field (the ordinary electric field) in our response to J. DeMeo and his similarly erroneous conception of the electrical and electromagnetic properties of orgone energy.[4] Nieborowski's observation that dipping the hand in water eliminated the effect for some time is proof of the electrostatically charged state of the human bodies employed by him in his experiments. Full body washing would make the effect disappear until the given subject established a new friction-polarized coupling with the ground. And if Nieborowski had checked the charge on the surface of the experimental body he would have found that the human subject in question would charge an electroscope before eliciting the plasma lumination and not charge it after washing with water and failing to elicit the plasma lumination. There can be no clearer proof of the electrostatic nature of the observations described in Reich's and Nieborowski's records. In contrast, the ambipolar field of human beings cannot be washed away by contact with water, even if cold water induces its contraction (our unpublished observations).

6. And now we come to the crux of the argument as to why, had we been peer-reviewing this paper, we would not have suggested its publication: Reich did not evacuate his own tubes, nor apparently did Nieborowski. One cannot purport to perform studies—save for very preliminary ones indeed—with two tubes, one "treated" and the other not, and conclude from their difference in response that the one placed inside an ORAC presented these lumination phenomena, and the other one, sealed ostensibly at the same pressure, did not. We have done these experiments ourselves with many tens of such tubes and can assure the reader that everything depends upon equal treatment and processing of vacuum tubes, and the relative variation between increasing sealed vacuum and increasing breakdown potential. When all such tubes are scrupulously made identical to each other and virtually completely clean of all contaminants, those that are sealed at submicron negative pressures require greater and greater potentials to elicit the normal blue glow of the electron plasma, just as those closed at increasing micron positive pressures present the phenomena at lower and lower potentials, with stronger and stronger positive ion columns, following precisely Paschen's curve. *None of these tubes need to be inserted inside an ORAC or a Faraday cage, for the lumination to be observed in the Paschen range of pres-*

The Myths of Orgone-Charged Vacor Tubes

Paulo Correa and Alexandra Correa

In a sense we welcome *Infinite Energy's* reprinting of Mr. Nieborowski's articles ("Orgone Charged Photomultiplier Tubes," *IE* #51 and "Orgone Charged Vacuum Tubes," *IE* #54) because they *indirectly* permit a sharp differentiation between the biophysical model and theory we have proposed (Aetherometry, or the Aetherometric Theory of Synchronicity) and Dr. W. Reich's Orgonomy (or, *a fortiori*, lesser variations of the latter)—a differentiation that only accentuates the nonscientific quality of the Nieborowski articles.

We take this opportunity to subscribe entirely to Donald Hotson's views regarding your reprinting of the E. Sittampalam article (*IE* #53)—it degrades the quality of *Infinite Energy*. (Indeed, there is little doubt, if any, that photons cannot collide—that is one of the reasons why, in the aetherometric system, they are massfree—and, likewise, it is certain that nuclear fission cannot be the energy source driving stellar processes.) The same can be said for the Nieborowski articles. Their only saving grace is that they now oblige us to undertake a *direct* identification of the systematic errors inherent to that part of the body of electric observations made by W. Reich which he once hoped would buttress his orgone theory.

We have so far refrained from systematically exposing these differences and the errors of observation and experimentation which W. Reich unwittingly committed to the framework of his orgonometric system. Specifically, one of the reasons we have not published our experimental notes on these *electrical* phenomena reported by Mr. Nieborowski—which are, in part, a reproduction of a concatenation of observations originally made by W. Reich—is precisely because they *fail* to present material evidence for the case of "orgone-charged vacuum tubes," let alone for the existence of orgone! In other words, the original observations made by Reich were incomplete, had methodological faults, and in some cases were deeply in error. Nieborowski commits similar mistakes and thus perpetuates nonscientific lore—even though, we assume, it is not his intention to do so.

Publication of these results by *IE* forces us now to correct these very basic errors in observation and the paralogical conclusions that we see being perpetuated, specifically, in the most recent article of Nieborowski.

1. The first of Reich's errors, upon which Nieborowski builds his case, is simply to assume that at 0.5 micron negative pressure one has reached a vacuum where no matter exists that may play a significant role. On the contrary, at such vacua there are still well over a million billion molecules of residual gas within the vessel. If one applies an electric field (DC or AC) to such vacua, heavy ion and electron plasmas will readily form in response to it. Unless orgone is just a *misnomer for plasma*, and unless plasma is somehow said to be massfree or noninertial (an obvious error), there is no reason to assume that plasma lumination (the generation of photons from the plasma discharge) serves as a marker, or an index, to some accumulation of orgone inside the tubes. To make such assumptions is gratuitous and faulty. Plasmas do not accumulate inside vacuum tubes. Plasmas are formed by the polarization, in space or in time, of intramolecular constituents—electrons and heavy ions.

Might one then not still assume that it is not the accumulation of plasma, or even its generation, that matters, but the presence of a massfree energy that has the direct property of luminating, or producing light? That aside from the light production from plasmas, there is "light production from orgone"? Out of gratuitousness, one might assume anything, but that is not science.

When one understands Aetherometry—and in particular its model for the production of inertial and electromagnetic effects—one understands how these are badly formulated questions because they already vitiate the problem by the way they are posed. For orgone cannot be said to be the photon-transmitting stimulus and at the same time be the photon itself, or even that which generates the photon directly as an expression of itself. To assume such a gratuitous notion could only throw one back to the theory of electromagnetism, where there is a wave-particle duality to light and it is light that propagates across space, or it is light that is transmitted across space. Why would one, then, need to invent a different theory? Orgone would just be light, *another misnomer, but this time for light.*

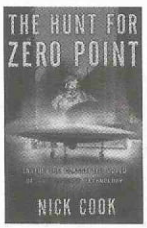
So, if orgone exists at all, it cannot be merely another term for plasma, or for light. Its existence would then be merely semantic or superfluous. Moreover, to exist at all, orgone must explain the production of light, the propagation of its stimulus, and still be distinct from a photon.

2. This brings us, then, to the second of Reich's errors—which was to *assume* that lumination was a *direct* property of orgone energy. This is what has effectively led all of his followers to become mired in the confusion between (primary) massfree energy (orgone, so to speak) and photon energy (electromagnetic energy, so to speak): they cannot conciliate the local nature of photons with the implied identity between light and orgone.

But light *is not* orgone, and orgone *is not* light—as taught by the aetherometric method. Rather, orgone is ambipolar energy—*i.e.* longitudinal massfree electric radiation—that confers, in its quality of an electric field, kinetic energy to massbound charge (electrons, heavy ions). Whereas light is constituted by *local photons* that are shed by such massbound charges (or plasmas) upon their deceleration or loss of kinetic energy. Hence, upon application of an electric field, plasma(s) will form in suitably evacuated tubes, and their deceleration by inelastic collisions will produce light. The blue light or normal glow discharge that is observed is essentially generated by the electron plasma inside the tubes. It follows therefore that *what is directly generating the observed light inside those tubes is the electron plasma*, not orgone energy, and certainly not orgone energy that has been accumulated inside them.

The Hunt for Zero Point: Inside the Classified World of Antigravity Technology

Nick Cook



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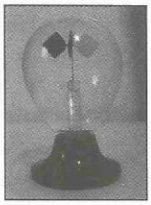

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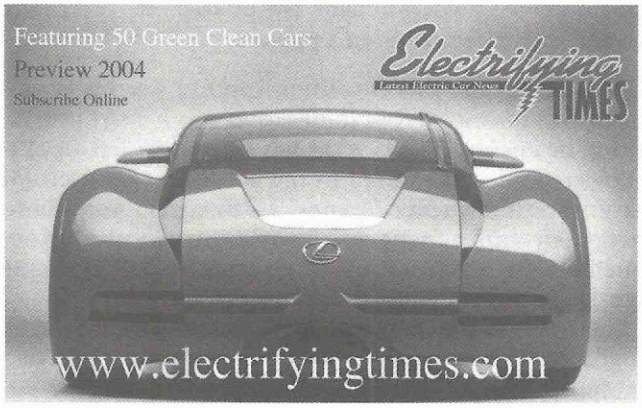

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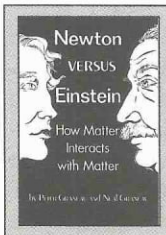

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experience with certain types of phenomena, perhaps special knowledge of a new instrumental technique, perhaps a natural manual dexterity in some important type of laboratory manipulation, perhaps an unreasonable stubbornness in seeking a better explanation of some phenomena which others have passed by as "explained" may be the key to a fruitful series of developments.

I should find it difficult to explain the secret of the effectiveness of the many able scientists I know or the relative ineffectiveness of others who seemed at the beginning to hold out great promise. Maybe it's just plain hard work, because, without downright hard work, there can be no success in a scientific career. All the productive scientists have been "smart" it is true, but the ways in which they have been "smart" have differed greatly. And, as I have said, they are all dedicated hard workers.

In the near future we shall hope to see a great expansion in our colleges and universities including our graduate schools of science and engineering. We should see an expansion of research activities adjacent to university campuses and in university-related institutes as the importance of our scientific education and research to our national growth is fully realized. We should also see a more vigorous and understanding support of uncommitted research in industrial and governmental as well as university laboratories, with the realization that such research over a period of years will result in faster discovery of radically new developments.

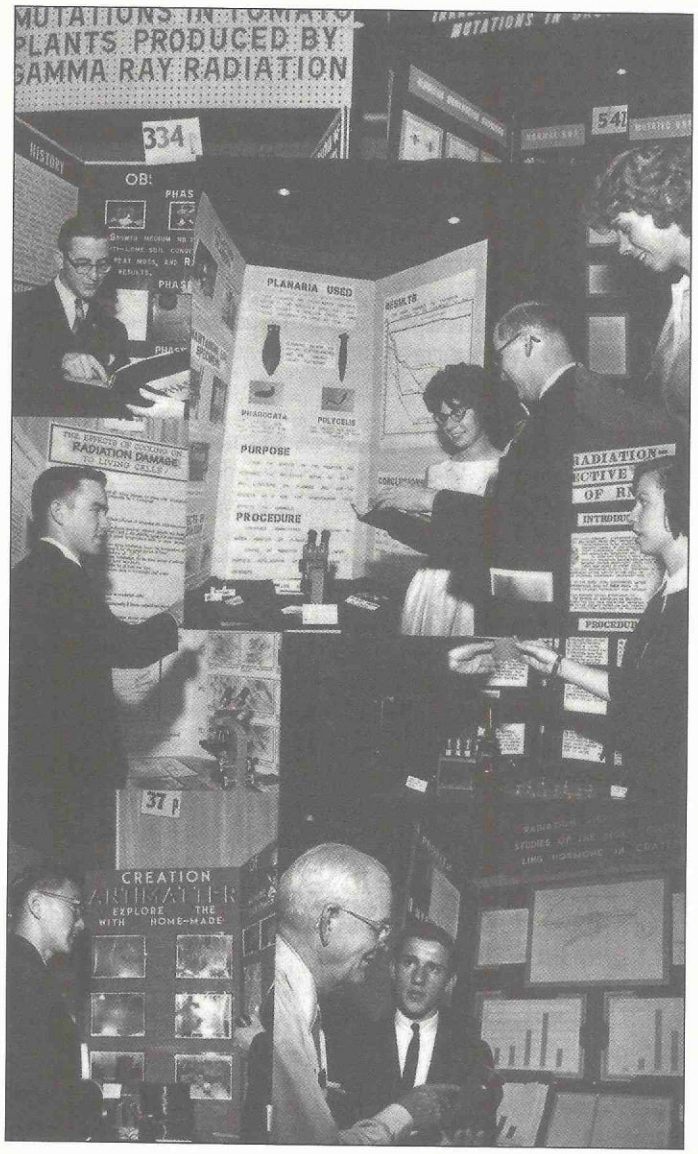
Engineer's Role Equally Important

Today, new discoveries in the nature of matter, the structure and the electrical and magnetic properties of materials, etc. are rapidly reduced to engineering application. Although I have not emphasized the role of the engineer, this is equally important in today's and tomorrow's society. To apply the results of scientific research rapidly and surely the engineer must have a sound and sophisticated knowledge of science and an adaptability which in general will be achieved only under a thoroughly revised engineering curriculum including some graduate training.

Nonscientists Must Understand Science

Turning to the education of the nonscientist there is a necessity of including a course or courses that will insure a better understanding of science as part of the general high school and college or university undergraduate curriculum. We live in an age in which, for better or worse, the influence of science is pervasive and revolutionary. It is a part of our culture which is shaping nearly every aspect of our lives and our institutions. We can no more ignore it than the man of the middle ages could ignore the Christian church or the feudal system. Properly nurtured and employed, science can provide us with marvelous tools for the solution of many of the weighty problems of our physical and social world.

The promise of the future lies in the hands of the dedicated and the educated. A most significant part of that promise lies in the field of science. I would invite the earnest young men and women who are prepared to study and work hard to join in the exciting and rewarding profession of science and the scientist.



Contestants at the 14th National Science Fair International in 1963, photographed while their nuclear-related exhibits were being judged.

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very effective means of developing adequate science teaching in their school systems.

Earlier Courses Provide Background

One of the chief purposes of high school science and undergraduate college science is to present the huge output of previous scientists to the student in a compressed form. They must give the student a meaningful, accurate, unified body of knowledge so that the general features of the sciences may be correctly perceived, so that new information to be acquired in the future can be related to the old and so that important features requiring further study can be recognized.

Graduate Schools Teach Research Methods

We turn now to the next step in the making of a scientist, namely, his training in the methods of carrying on scientific investigation. The principal centers for this type of instruction are the graduate schools of our great universities. The graduate holding a bachelor's degree in science has a good knowledge of his field, is able to perform a variety of laboratory tasks and may, with on-the-job training, develop into a creative research scientist. But as a general rule we rely on the rigorous training of our graduate schools to convert the trained intelligence of the holder of a bachelor's degree into the creative intelligence of the research scientist. The Ph.D. degree is the symbol of this creative intelligence.

The chief instructional technique of the graduate school is to put the student in the laboratory under the supervision of a master scientist to do a piece of original scientific investigation on a problem of considerable importance and difficulty. Here he learns a variety of experimental techniques. He learns the importance of asking big questions. He learns how to set up a meaningful experiment and how to extract correct answers from the data he collects. He learns the importance of letting the unexpected result lead him to new conclusions or at least to new experiments.

Graduate research is a rigorous, demanding experience which makes an enormous change in the scientific effectiveness of the candidate. At the better institutions the research interests of the professor are very advanced and are likely to be in a frontier area far beyond the material currently appearing in undergraduate textbooks. The professor is also greatly stimulated by the student. The student is usually brilliant, comes to the problem with a rather different educational background from that of his professor, and is eager to work hard to find out what the experiments will reveal. With this fresh outlook it frequently happens that he contributes greatly to the success of the research and may transform it into an advance far greater than might reasonably have been expected at the initial stages of the work.

America's Graduate Schools Are Excellent

The American people can regard with great pride the graduate schools of our great universities. They meet all the qualifications of excellence. They train virtually all of our great creative scientists. The scientific research done under the student-professor symbolic working arrangement adds a major fraction to our truly important new knowledge.

I could cite many, many examples of this. The selection of any scientific problem involves a judgment concerning what is worth investigation. In the first-rank graduate schools it is the big problems which are attacked. It is free research. The fact that over forty living Americans hold the Nobel Prize in chemistry, physics, or medicine attests to the excellence of our graduate schools of science. Unfortunately, in today's world there is not a sufficient number of such schools. A study made by the President's Science Advisory Committee in 1960 included recommendations that it be our national science policy to strengthen these existing schools, to increase their number, and to work out ways to extend the mutual creative stimulation of graduate education and research into more of the laboratories in which our fundamental research is done.

It is important that the standard of excellence of our top-rate universities be maintained and extended to more institutions. In the extension of scientific knowledge excellence is crucial. There is an enormous difference between pretty good and the very best. A system of scientific training and research institutions which can produce and support a few Enrico Fermis or John Von Neumanns or Ernest Lawrences will be profoundly more effective than one which fails to do so.

Graduate Study Decisions May Be Deferred

A potential young scientist listening to these words may be hesitant to embark on such a foreboding and rigorous course of training. Therefore, a few words of comfort may be in order. Your decision whether or not to consider graduate training in science can be deferred to the middle or later years of your undergraduate college career. By then your decision will be based on a clearer knowledge of your abilities, interests, and intellectual performance. Should you then decide that your talents and interests lie in other directions there is a strong likelihood that the science courses which you studied will nevertheless form a significant part of your total education.

While graduate training usually takes from three to five years, the extra expense attached to this period can be greatly lessened by the many teaching and research appointments and fellowships which are available. In many fields the student can expect to pay all his living and school expenses from such appointments.

A further comment that I should make is that there is plenty of room in scientific research for those who are not in the genius category. All Ph.D.s of course are better than average in intelligence, but few of them indeed approach the manifestly superior intelligence of Enrico Fermi or John Von Neumann. There is a large volume of work which needs to be done and which can be done very well by the trained scientist of more modest endowments. Furthermore, much of the potential of a Fermi or a Von Neumann would be lost were there not many other scientists to try out their suggestions or to turn up new phenomena and new data for them to study and consider.

Research Utilizes Many Talents

Creative research calls for a combination of qualities, only one of which is superior intelligence. It is difficult to specify the combination of characteristics which may be of crucial importance for success in solving a specified scientific problem. Perhaps an intuition or a "feel" derived from lengthy

nature of a meson—is of great significance.

I believe that most people have a deep psychological need to feel that what they are doing is of some importance. The scientist feels the satisfaction of this need, and this gives drive and zest to his efforts. This is particularly true if, from time to time, his efforts are rewarded by the thrill of discovery. In his search he knows that in the final analysis his success as a scientist is measured against the criteria of nature—rather than the judgments of persons. Science is self-correcting in that spurious results will sooner or later be unmasked by new experiments or the attempted verification of previous conclusions. Hence it can more readily establish truth and confound error than other more abstract fields of study. A scientist who is correct can prove he is correct, and by a proper marshalling of experimental evidence can convince his colleagues regardless of their superior reputation, seniority, or rank.

Scientific research is a stimulating activity requiring constant assimilation of new facts, theories, and techniques. This feature appeals to many gifted persons who would be stifled by the repetitive, dulling routine of many other occupations. A career in scientific research has many deep intellectual satisfactions which appeal strongly to the person of superior natural abilities. Let us turn now to a consideration of how an interested young person may make a career in this exciting field.

Science is an organized body of knowledge and a method of extending or revising that body of knowledge by observation, hypothesis formation, and experiment. The training of a scientist is a two-step process—the mastery of a body of knowledge developed by previous workers and the mastery of a technique for extending that knowledge. I sometimes liken the role of the scientist to that of a mountain climber who with great care and exertion achieves some great prominence from which he is able to perceive immediately and clearly new vistas which are hidden from the sight of those down in the valley below even though many of those in the valley may have better eyesight.

Mastering Existing Knowledge of Science

New science builds on the work of the past. The scientist of today stands on the shoulders of the giants of yesterday. Therefore, the first task of any serious aspirant toward a career in science is to master the recorded history of the past. The task of the effective teacher is to organize and present that history concisely and effectively. Our libraries are so filled with an enormous accumulation of facts, hypotheses, and theories that the complete mastery of any science or even one major branch of a single science is a quite impossible task. Hence there must be a judicious selection of material—a judgment concerning the relative importance of various fields of study at various stages of the educational ladder, and a continuing judgment concerning the relative importance of facts, laws and correlations.

We are greatly helped in this effort by the great unity of much of science because of the fundamental laws or generalizations underlying all natural phenomena. In physics and chemistry, for example, we are enormously aided by the laws of thermodynamics, the laws of conservation of momentum and energy. We are also aided by the circumstance that many decades of past work in science may become logical and clear once some satisfactory organizing law or theory is evolved.

By intensive study of the organizing law the new scientist may understand immediately many hundreds of individual facts which were quite mysterious to the past generation of scientists. New mathematical techniques may also make it possible to explain or quickly derive numerous experimental facts which could only be understood at the expense of great labor by previous students. Therefore, it is the purpose of high school and undergraduate education in science to teach with the utmost economy of effort the organizing principles which may unlock for the student the important heritage of the past. Because the relative importance of facts is subject to rapid obsolescence, the goal is not to teach facts alone, but a system of understanding facts so that the new knowledge can later be absorbed.

Needed: Better High School Courses

There is no ideal way to teach high school or college science courses and we may expect a variety of approaches without a clear choice among them as to effectiveness. Nevertheless, whatever approach is tried must be subject to change in content to accommodate the material to new advances in science, particularly advances occasioned by important discoveries. Unfortunately, our high school courses have not changed too much over the years and such changes as have been made until very recently are mostly in the way of accretion of new material without significant deletion of the old.

Another problem in science education is the need for still more able and dedicated teachers. Poor salaries, the inadequate community status accorded to teachers, and misguided accreditation requirements have repelled many qualified professional scientists from a career in high school science teaching. Adequate preparation in his subject matter is essential to a good teacher, and normally a high school course in chemistry should, where at all possible, be taught by a teacher with a college degree in chemistry, and a high school course in biology by a teacher with a degree in zoology or biology. Such a person can usually better evaluate new developments in the field and effectively interpret them to young people. Yet it is a rare high school indeed that has such a professionally trained science teacher. New attitudes toward teacher salaries and recruitment would assist in improving this critical situation. It is fortunate that our country nevertheless has many able and dedicated high school science teachers who are willing to make the necessary sacrifices.

One encouraging development of the past few years is the renewed interest of the universities, the professional scientific societies, the private foundations, and many governmental agencies—particularly the National Science Foundation—in the plight of the high schools. This interest has taken the form of summer institutes for the retraining of teachers, writing projects to revise outdated course outlines, textbooks and laboratory manuals, the preparation of films, TV programs and TV courses, and the publication of a wealth of new explanatory and authoritative scientific material in paperback form. School board members, school administrators, and interested citizens who are acquainted with these programs find them a new and

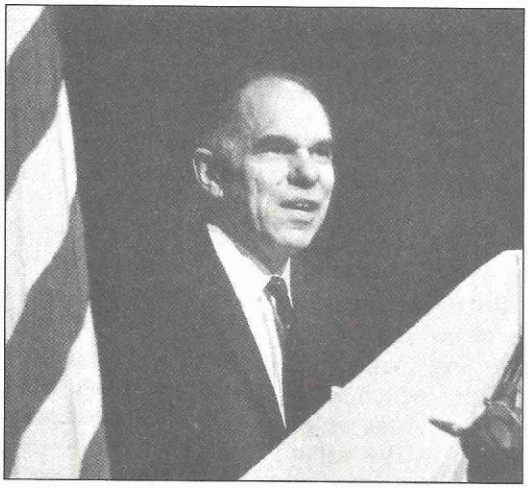
The Creative Scientist: His Training and His Role

Glenn T. Seaborg

Address delivered to the 14th National Science Fair International in Albuquerque, New Mexico, 1963.

It was only a century or two ago that modern science became an organized study of natural phenomena deduced from experimental evidence. Since that time applied science and invention have influenced the life of the individual, the development of industry, the evolution of political societies, and the course of history. In the past few decades we have seen a great increase in the impact of science on our society owing to a new factor which was not previously present. This new factor is the systematic and intensive accumulation of new scientific knowledge—the result of basic or fundamental scientific research.

We now know that the search for new knowledge, if not restricted to subjects of foreseeable and immediate practical importance, results in an unexpected increase in our understanding of physical or biological phenomena. These increases, in turn, give rise to far-reaching practical applications which could not have been anticipated from the original basic research. Our scientific knowledge and technology are advancing at an explosive rate. The time lag between the discovery of a fundamentally new scientific principle and its application in engineering or medicine is now very short, and these rapid developments are changing the lives of all of us in many ways which we only dimly perceive.



Dr. Seaborg as he delivered the address in 1963.

Brainpower: A Precious National Resource

Because of our inescapable dependence on modern science and technology we must regard trained brainpower as a precious natural resource. The extent to which we discover exceptional intellectual talent, encourage and develop it, and provide conditions for its effective flowering will be a measure of our success in meeting the truly challenging problems which technology and population growth are posing for us in the remainder of this troubled twentieth century.

I refer broadly to two types of trained brainpower. One is represented by the professional scientist or engineer, the other by the educated person in other fields who has mastered enough of the meaning and content of modern science to make valid judgments on the many questions raised by the influence of science on his field, whether it be law, medicine, politics, military affairs, industrial management, or some other field.

It is fitting, therefore, that considerable attention be paid to the early identification of intellectual talent. Tonight we are gathered to participate in one attempt at the identification of boys and girls who have exceptional aptitude for a creative and productive career in science. We are here to honor young men and women who have demonstrated by their conception and execution of some science project that they have a strong motivation and exceptional promise for a scientific education.

I think it is quite proper that we pause on regular occasions to acknowledge the intellectual, esthetic, and idealistic aspirations of our young people and encourage them by recognizing their academic excellence. Not unnaturally, a young person is influenced to seek goals which are recognized and respected. If praise is reserved only for athletic prowess or monetary success, who can blame him if he seeks these even if it means sacrificing a great potential in some other field. Perhaps some of you may have seen the Lichty cartoon of a month ago in which a father admonished his son: "The future is wide open for a science graduate, Otis! But he can do still better if he can hit over .300 and catch fly balls!"

So, I am most happy to extend my personal congratulations to these young men and women. It would be extraordinary indeed if all of you should develop into brilliant scientists of international reputation. I would be the last to lay the heavy burden of such an expectation on your shoulders. It would also be extraordinary if any of you failed to contribute in some way and in some pursuit, which none of us can predict here tonight, much more than an average share of intellectual achievement.

I would like now to mention briefly a few important steps in the education of a scientist, and a few attractive features of the life of a research scientist.

Research Is Important Work

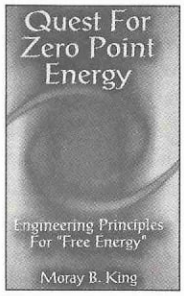
The work of a research scientist is of great interest and importance. Often it is difficult to relate his work to matters of dollars and cents but in the value system of the scientist the subject he has under study—whether this be the origin of the solar system, the biochemical basis of heredity, or the

judgements of "persons"—persons such as Seaborg or Huizenga, who tell the President of the United States and then the world that a new scientific finding is not such-and-such, based on totally anti-scientific *a priorisms* ("It simply can't be true. . .etc., etc."). This is another sad howler from Seaborg: "A scientist who is correct can prove he is correct, and by a proper marshalling of experimental evidence can convince his colleagues regardless of their superior reputation, seniority, or rank." Oh, sure, just serve up a a few hundred bullet-proof papers on LENR and the Scientific Establishment will roll right over! Evidence with revolutionary implications means *nothing* to the hide-bound theorists of today.

Then comes blatant propaganda about how, "By intensive study of the organizing law the new scientist may understand immediately many hundreds of individual facts which were quite mysterious to the past generation of scientists." That's it, man, just memorize those "laws" and you have the whole shebang in hand, the world of scientific "facts" at your fingertips! Implied, of course, is that those "laws" can't be wrong, because, after all, from them can be derived "facts." Get it? After such nonsense, a disastrous, false assertion popped out of Seaborg's mouth, which a quarter century later would come to characterize perfectly the idiotic rationale for launching the War Against Cold Fusion: "New mathematical techniques may also make it possible to explain or quickly derive numerous experimental facts which could only be understood at the expense of great labor by previous students." *Mathematically derive an experimental fact?* Isn't that how LENR phenomena were so resoundingly dismissed by Seaborg *et al.*—by mathematical calculation from sacrosanct "laws," purporting to show that certain experiments *had* to be the result of error?

Seaborg tells us how it should be with graduate students: "He learns how to set up a meaningful experiment and how to extract correct answers from the data he collects. He learns the importance of letting the unexpected result lead him to new conclusions or at least to new experiments." Of course, Seaborg can't possibly be talking about truly anomalous, "law"-violating results that could lead to "new conclusions." He emphasizes "correct answers," which in his lexicon cannot be allowed to appear to violate those laws. He then describes a hypothetical graduate student. One who recalls the early history of the LENR field may immediately think of Nigel Packham, a doctoral student under Professor John Bockris at Texas A&M University during 1989-1990 and afterward, who through hard work found irrefutable tritium evolution in cold fusion cells. That is the kind of research that should merit a Nobel Prize, at least. But, not so fast. Seaborg describes an open-minded graduate student: "With this fresh outlook it frequently happens that he contributes greatly to the success of the research and may transform it into an advance far greater than might reasonably have been expected at the initial stages of the work." Yes, that is precisely what Packham did under Bockris, except that Packham was "rewarded" by being called a likely fraud-perpetrator in a slanderous article by Gary Taubes in *Science* magazine, which spanned five pages of that still unrepentant journal in June 1990. So, it did not work out for Packham in 1990 as Seaborg had suggested it would back in 1963. Packham was driven out of the field and has been working in the U.S. space program doing human factors biophysical research.

With these now all-too-evident intimations of the disaster for science that would later emerge in the Cold Fusion War, it is perhaps a blessing for him that Seaborg is not around to see the consequence of his acts: the inexcusable delay in recognizing that a new window on physics and chemistry had opened, one with a huge technological potential. But the eventual blossoming of that initially small sprout of scientific discovery that Seaborg so incompetently sought to abolish could not be stopped. "Law"-defying experiments in LENR continue and become an ever larger threat to what Seaborg thought he knew about science. We can agree with at least one of Seaborg's 1963 truisms, although not in the way he intended it: "Science is self-correcting in that spurious results will sooner or later be unmasked by new experiments or the attempted verification of previous conclusions." The unmasking that is occurring is the crushing correction that experiments are delivering to the fraudulent "previous conclusion" of Seaborg and Huizenga that there was nothing to investigate in the cold fusion claims.



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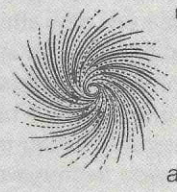

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Of course the panel that Seaborg recommended ended up with the negative view put forth by Seaborg on Day One. How could it have done otherwise? Just consider who was on the panel in leading roles. First we had Seaborg's close colleague, Prof. John Huizenga, then of the University of Rochester, the panel's driving force, who later wrote his version of cold fusion history (*Cold Fusion: The Scientific Fiasco of the Century*, 1992). In Huizenga's book, we find confirmation of Seaborg's negativity on April 14, 1989, but not until the *SI* interview did we have such stark words from Seaborg himself.

Robert O. Hunter, Jr., a hot fusion man, was at the time the Director of DOE's Office of Energy Research. It was he who called upon Seaborg to come to Washington, according to Huizenga. On the morning of April 14, Seaborg briefed Admiral Watkins, then DOE Secretary, and later John Sununu, then President Bush's top advisor.

By Huizenga's own statements, Huizenga was opposed to moves to have a cold fusion investigation. He wrote in his book: ***"My initial feeling was that the whole cold fusion episode would be short-lived and that it would be wise to delay appointing such a panel.*** *However, the persuasive manner of both Seaborg and Schoettler and the ongoing press reports on cold fusion convinced me that such a panel was necessary and timely from the Department of Energy's point of view for reasons to be discussed in the next chapter."* [*Infinite Energy's* emphasis]

Huizenga and Seaborg had already determined that the Utah results were unimportant, according to Huizenga in his book and elsewhere, because ". . .cold fusion should not be possible according to current nuclear theory, which is supported by a large body of experimental data."

But that was not the end of the bigotry on the DOE panel. We have this account by Gary Taubes (in *Bad Science*, 1993) from Dr. William Happer, a Princeton hot fusioneer: "Happer had decided upon hearing of cold fusion that it was probably wrong. In fact, a *Scientific American* reporter had called him a few days after the announcement, and Happer had harangued him for over an hour on the various aspects of fusion—its physics, the fatal effects of neutrons—that made cold fusion so implausible. 'The thing I didn't have the nerve to do was say that *just by looking at these guys on television, it was obvious that they were incompetent boobs.*'" [Infinite Energy's emphasis] In 2004, Happer remains convinced that he was correct from the start, and he is still eager to have LENR science killed with the same bureaucratic scam that was used in 1989: "But if you put together a credible committee, you can try to put the issue to bed for some time. It will come back. The believers never stop believing," according to Happer (quoted by Toni Feder in *Physics Today*, April 2004).

So much for the "impartiality" of the DOE cold fusion panel of 1989. Let us hope that the evaluation committee in 2004 will merit our confidence. And so much for the reputation of Glenn Seaborg, who helped initiate the disgraceful behavior of DOE over the past fifteen years—its refusal, at every turn until recently, to reconsider its highly flawed cold fusion report of November 1989. During his life, Seaborg did nothing to make amends. History should remember him for that. For now, one of his other tangible legacies is having his name permanently affixed to element number 106, seaborgium.

A Stroll Down Memory Lane: 1964

Because I happen to be an inveterate packrat, I tend to collect old scientific literature, magazines, and other paraphernalia, which others might long-ago have shredded, but which I imagine might eventually be useful. And on occasion, one piece of pack-ratted scientific memorabilia percolates to the top of a pile and sends a message across the sands of time. So it was for a small pamphlet that I saved from my high school years—from 1964, to be precise. It was published by the U.S. Atomic Energy Commission (AEC), that era's precursor of today's DOE. It features an address by Glenn T. Seaborg, who was then AEC Chairman, to the 14th National Science Fair International (NSFI) at Albuquerque, New Mexico in 1963. Seaborg's talk, "The Creative Scientist: His Training & His Role," is so quaint (note, for example, the gender bias in the title) and pregnant with intimations about future scientific history, that I consider it to be a useful accompaniment to this commentary. We reprint it in its entirety. Enjoy!

Notable about Seaborg's lecture is its tiresome blandness and repetition of bureaucratic-sounding nostrums about how the young people he is addressing should view their prospective careers in science and engineering. Note especially: Seaborg gives no obvious challenge whatsoever to the students to find something truly *new*, something really revolutionary, or—heaven forefend—something fundamentally *wrong* with existing theories of nature. The implication is clear, and even spelled out in its deification of certain "genius" scientists: "Furthermore, much of the potential of a Fermi or a Von Neumann would be lost were there not many other scientists to try out their suggestions or to turn up new phenomena and new data for them to study and consider." The not-so-subliminal message is clear: "You are likely to be drones in the house (hive?) of science, whose work is to be evaluated and *used* by these superior kings and queens, who disdain getting their hands dirty in your sort of pedestrian experimentation. Esteemed theorists will consider, accept, or reject, the value of *your* work. Boy or girl, know your place."

I regret to say that had I been in the audience listening to Seaborg in 1963, I might then have been in awe of this great messenger of supposed wisdom about the process of science. I would not then have been sensitive to the implicit distortions being served up. Seaborg airily offered this canard: "The time lag between the discovery of a fundamentally new scientific principle and its application in engineering or medicine is now very short." This is utter nonsense; it is blather. It pertains only to some new kind of technoid gadgetry based on accepted principles that engineers and marketers may disgorge, not to the fruits of "fundamentally new scientific principles." In fact, those "fundamentally new scientific principles" that are allowed admission to the cathedral of official science are so rare as to be virtually non-existent these days. And as we have seen, thanks to the likes of Seaborg, substantial evidence for low-energy nuclear reaction phenomena and excess heat have been side-tracked for at least fifteen years—and perhaps the farce will go on much longer. (An unbiased DOE review of LENR is by no means assured.) At the same time, all manner of experimentally untethered, nonsensical theory in physics is bandied about and rewarded as received cosmic wisdom.

At another point Seaborg told the students, "In his search he knows that in the final analysis his success as a scientist is measured against the criteria of nature—rather than the judgments of persons." That was another con-job from Seaborg. That statement may be true and self-evident as far as Science, the abstract, ideal process may go, but it is most certainly not the *real experience* of pioneering scientists these days. The work of frontier scientists now faces immediate scorn and ridicule by the rash

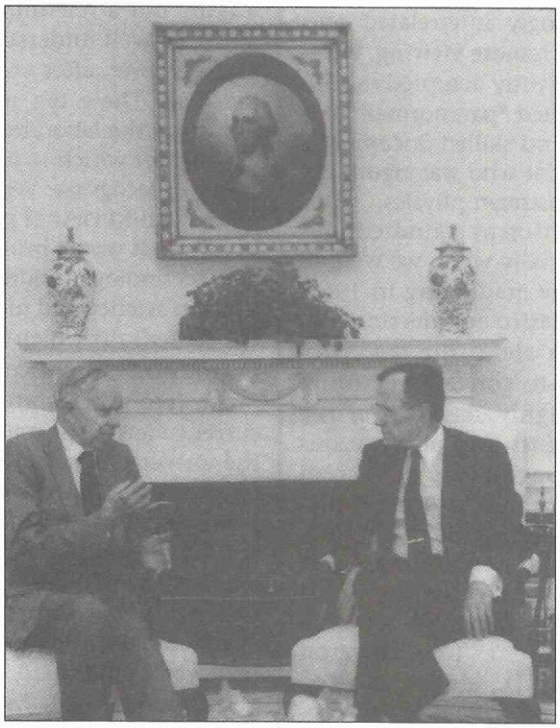
Intimations of Disaster:

Glenn Seaborg, the Scientific Process, and the Origin of the "Cold Fusion War"

Eugene F. Mallove

Almost seven years ago in an issue of *Infinite Energy* (#15/16, July-November 1997), we discussed some of the material that follows. But in 2004, with the U.S. Department of Energy's impending review of the past fifteen years of evidence for low-energy nuclear reactions (a.k.a. "cold fusion"), it is an appropriate time to review—in a fresh light—a most critical turning point in the saga of cold fusion. In an episode which occurred in the spring of 1989, we find the seeds of the disastrous DOE response to cold fusion. Upon further investigation, I later found that the false premises that gave rise to the "Cold Fusion War" were evident as far back as 1964.

The events in question occurred only three weeks after March 23, 1989, when Drs. Martin Fleischmann and Stanley Pons made their startling announcement at the University of Utah of excess heat production and low-energy nuclear reactions. Nobel laureate Glenn T. Seaborg had been called in to brief President George H.W. Bush (the father of today's U.S. President George W. Bush). Days before Seaborg spoke to the first President Bush, there had been a very enthusiastically received talk by Dr. Pons before the American Chemical Society Meeting in Dallas, Texas (April 12, 1989).



Glenn Seaborg briefing President George Bush on "cold fusion" at the White House on April 14, 1989. Photo courtesy of the Ernest Orlando Lawrence Berkeley National Laboratory.

Even though the jury was certainly still out on the evidence for or against "cold fusion," Seaborg, *through some as-yet-to-be-revealed process* (though he certainly had conducted no experiments), had determined that cold fusion was not what it was claimed to be. On April 14, 1989 Seaborg told President Bush that *"it is not due to nuclear fusion."* Thus was launched a sham investigation, biased from the outset by this Nobel luminary's words to the U.S. President, who had taken office only a few months earlier. Of course, Seaborg had ample time between 1989 and when he passed away (in 1999) to investigate what was even in 1992 quite mountainous evidence that had been compiled for low-energy nuclear reactions and excess energy production. During his life, Seaborg did not advise any U.S. President, nor any other official to our knowledge, that the case *against* cold fusion, which he helped set in motion, should be re-examined. In fact, we now know from Seaborg back in 1997 that he was still unrepentant and biased. We discovered this extremely revealing account of Glenn Seaborg's actions in the spring of 1989, which appeared in an issue of *Skeptical Inquirer*, November/December 1997, as part of "The Elemental Man: An Interview with Glenn T. Seaborg":

SI: During the early stages of the cold fusion furor, President Bush asked you to come to the White House and give him your views on the matter. What happened? What did you tell him?

Seaborg: In April 1989, I was called back to Washington to brief George Bush on "cold fusion," the totally unexpected phenomenon that University of Utah scientists announced they had discovered by the simple process of electrolysis of heavy water. A couple of days earlier, the purported co-discoverer of "cold fusion," University of Utah electrochemist Stanley Pons, spoke to an enthusiastic standing-room-only audience of chemists at the semi-annual meeting of the American Chemical Society in Dallas. His talk had attracted so much attention that, apparently, the news had reached the White House. After briefing White House Chief of Staff John Sununu, I went into the Oval Office to brief President Bush on April 14, 1989.

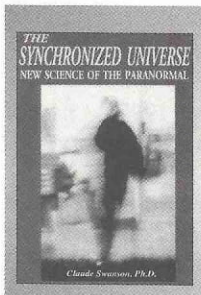
I told him about my role in the discovery of the radioactive iodine that had been used a couple of days earlier to treat his wife, Barbara, and said that a similar treatment with radioactive iodine had effected a miraculous cure for my mother, who was suffering from the same condition as Barbara. The president facetiously said that Barbara is now radioactive and she is not allowed to kiss their dog as long as this condition prevails, but he implied that it didn't seem that this prohibition included himself—the president.

I then went on and described briefly the situation with respect to cold fusion. ***I indicated that this is not a valid observation—that is, that it is not due to nuclear fusion—but, on the other hand, it must be investigated.*** *The president seemed very interested and convinced by my assessment, and encouraged us very much to go ahead with an investigation.* [*Infinite Energy's* emphasis]

I might add that the panel I recommended to study the purported "cold fusion" process was created and about six months later came out with a report disputing the validity of the observation, pretty much in line with the view I adopted in my briefing of the president. Also it is interesting to note that President Bush himself, two years later, in May 1991, benefitted from treatment with the same radioactive iodine (iodine-131).

—(End of the *Skeptical Inquirer* interview section)—

Book Reviews



The Synchronized Universe:
New Science of the Paranormal

by Claude Swanson
ISBN 0-9745261-0-X
$19.95 Paperback, 307 pp.
Poseidia Press, 2003

Review by Eugene F. Mallove

The Synchronized Universe (available from *Infinite Energy*, www.infinite-energy.com) is a courageous, audacious, and very sophisticated catalog of seemingly interrelated phenomena—such as psychokinesis, ESP, remote viewing, etc.—which, if they are real, transcend currently accepted models of physics; they are thus, for now, called "paranormal." It is an almost unique work of synthesis and skilled documentation, coming as it does from a physicist who was rigorously trained at MIT and Princeton in mainstream physics.

I must confess that I view Dr. Swanson as a kindred spirit, though I did not know him personally when we were in the same entering MIT class, the one graduating in 1969; he majored in physics, and I in aero/astro engineering. But Dr. Swanson, whose heretical views about the *process* of science happened—independently—to converge with my own, formerly would have been highly skeptical of the cornucopia of paranormal experiments and observations that he so ably weaves together. Though I may not accept all of his conclusions about many of these (to me) unfamiliar phenomena and the beginnings of the cross-phenomena theoretical understanding that he proposes, I give this significant work my highest recommendation. It is a landmark book that deserves wide recognition.

After MIT, Claude Swanson went to Princeton University, where he obtained his Ph.D., also in physics. For many years he worked in R&D on a host of conventional research projects (and he still does), never imagining that one day he would find himself pursuing deep scientific heresy, in fact *many* heresies. Some of these are far more threatening to the present scientific enterprise than "mere" new energy sources, such as LENR and vacuum energy.

What is most refreshing about the approach he takes in this book are the very great efforts he has made to verify *first hand* some of the so-called paranormal phenomena he and others have explored. For example—horror of horrors, literally—he has taken what turned out to be photographs of anomalous phenomena at an alleged "haunted house"! Furthermore, while it has not been possible for him to have had first hand experience with the many classes of phenomena that are dubbed "paranormal," I give the author enormous credit for having dug up and referenced a huge body of original material, so that interested readers can explore these areas for themselves. The aspect of such phenomena that had caught my attention earlier are the seemingly bullet-proof psychokinetic experiments, which have been conducted for over two decades by Prof. Robert Jahn (formerly Princeton's Dean of Engineering) and his colleagues at the Princeton Engineering Anomalies Research (PEAR) group. The author covers these too, of course.

Swanson's experience as a heretic apparently began when he was forced to conclude that some "remote viewing" experiments, which had been reported to him, appeared to him to be very sound. He recalls, "That was the day I came face to face with information that I could not dismiss and could not explain." The troubling thought began to enter his mind: "But what if modern science still has a few things to learn? What if present-day physics is leaving out a few important truths about the universe as well." So well understated!

His answer, after years of exploration: "This seems to be the case. There are many phenomena which have been proven in the laboratory [yes, he also lists among these cold fusion], yet which mainstream physics steadfastly refuses to admit or recognize. Why? Because if it did, it would turn the present world view of physics upside down. But there is good news too. It would bring a golden age of new discoveries and new technology, undreamed of today. And, it would bring modern science and modern religion much closer to healing the ancient rift which separates them."

Swanson's microscope is sharply focused on some of the preposterous affectations of modern physics. About the current view of physics that up to 95% of the "matter" of the universe is supposedly "dark" and unknown, Swanson quotes Princeton's Prof. James Peebles, "It is an embarrassment that the dominant forms of matter in the universe are hypothetical. . ." He approvingly quotes Peebles' antagonist, astronomer Halton Arp: "The tradition of 'peer review' of articles published by professional journals has degenerated into almost total censorship. Originally, a reviewer could help an author improve his article by pointing out errors in calculation, references, clarity, etc., but scientists, in their fervid attachment to their own theories, have now mostly used their selection as a referee to reject publication of any result that would be unfavorable to their own personal commitment. . .The result is that real investigative science is now mostly an underground activity." (Arp, 2000)

This work is quite impressive, even though I am far from confident that Dr. Swanson's outline of a theory to encompass the phenomena he catalogs is going in the right direction. But, no matter—pun intended—if even a small fraction of these phenomena are valid, the answer to *how* they occur will certainly have to be in the *massless, i.e.* "non-inertial matter" or "no matter" realm.

This is a marvelous book that I am proud to recommend to anyone. It is apparently only the first volume of a much larger series of works on anomalous phenomena in general that the author has planned, and which may require deep alterations in physics. We should wish him well and await his further insights. He has just begun a new lifework.

tation system that allowed data acquisition over a much longer time than was possible in the team's previous bubble fusion experiments. According to the new data, the observed neutron emission was several orders of magnitude greater than background and had extremely high statistical accuracy. Tritium, which also is produced during the fusion reactions, was measured and the amount produced was found to be consistent with the observed neutron production rate.

Earlier test data, which were reported in *Science* (Vol. 295, March 2002), indicated that nuclear fusion had occurred, but these data were questioned because they were taken with less precise instrumentation. "These extensive new experiments have replicated and extended our earlier results and hopefully answer all of the previous questions surrounding our discovery," said Richard T. Lahey Jr., the Edward E. Hood Professor of Engineering at Rensselaer and the director of the analytical part of the joint research project. Other fusion techniques, such as those that use strong magnetic fields or lasers to contain the plasma, cannot easily achieve the necessary compression, Lahey said. In the approach to be published in *Physical Review E*, spherical compression of the plasma was achieved due to the inertia of the liquid surrounding the imploding bubbles.

Researchers Rusi Taleyarkhan, Colin West, and Jae-Seon Cho conducted the bubble fusion experiments at ORNL. At Rensselaer and in Russia, Professors Lahey and Robert I. Nigmatulin performed the theoretical analysis of the bubble dynamics and predicted the shock-induced pressures, temperatures, and densities in the imploding vapor bubbles. Robert Block, professor emeritus of nuclear engineering at Rensselaer, helped to design, set up, and calibrate a state-of-the-art neutron and gamma ray detection system for the new experiments.

Special hydrodynamic shock codes have been developed in both Russia and at Rensselaer to support and interpret the ORNL experiments. These computer codes indicated that the peak gas temperatures and densities in the ORNL experiments were sufficiently high to create fusion reactions. Indeed, the theoretical shock code predictions of deuterium-deuterium (D-D) fusion were consistent with the ORNL data.

The research team leaders are all well known authorities in the fields of multiphase flow and heat transfer technology and nuclear engineering. Taleyarkhan, a fellow of the American Nuclear Society (ANS) and the program's director, held the position of Distinguished Scientist at ORNL, and is currently the Ardent Bement Jr. Professor of Nuclear Engineering at Purdue University. Lahey is a fellow of both the ANS and the American Society of Mechanical Engineers (ASME), and is a member of the National Academy of Engineering (NAE). Nigmatulin is a visiting scholar at Rensselaer, a member of the Russian Duma, and the president of the Bashkortonstan branch of the Russian Academy of Sciences (RAS). Block is a fellow of the ANS and is the longtime director of the Gaerttner Linear Accelerator (LINAC) Laboratory at Rensselaer.

"What we are doing, in effect, is producing nuclear emissions in a simple desktop apparatus," said Rusi Taleyarkhan, the principal investigator and a professor of nuclear engineering at Purdue University. "That really is the magnitude of the discovery—the ability to use simple mechanical force for the first time in history to initiate conditions comparable to the interior of stars."

The technology might one day, in theory, lead to a new source of clean energy. It may result in a new class of low-cost, compact detectors for security applications that use neutrons to probe the contents of suitcases; devices for research that use neutrons to analyze the molecular structures of materials; machines that cheaply manufacture new synthetic materials and efficiently produce tritium, which is used for numerous applications ranging from medical imaging to watch dials; and a new technique to study various phenomena in cosmology, including the workings of neutron stars and black holes.

Since the team's paper in *Science* came out, the researchers have acquired additional funding from the U.S. Defense Advanced Research Projects Agency. The device is a clear glass canister about the height of two coffee mugs stacked on top of one another. Inside the canister is deuterated acetone. The researchers expose the clear canister of liquid to pulses of neutrons every five ms, causing tiny cavities to form. At the same time, the liquid is bombarded with a specific frequency of ultrasound, which causes the cavities to form into bubbles that are about 60 nm across. The bubbles then expand to about 6 mm, large enough to be seen with the unaided eye. Within nanoseconds these large bubbles contract with tremendous force, returning to roughly their original size, and release flashes of light in a well-known phenomenon known as sonoluminescence. Because the bubbles grow to such a relatively large size before they implode, their contraction causes extreme temperatures and pressures comparable to those found in the interiors of stars. Researches estimate that temperatures inside the imploding bubbles reach 10^7°C and pressures of some 10^{14} Pa.

In future versions of the experiment, the tritium produced might then be used as a fuel to drive energy-producing reactions in which it fuses with deuterium. One key to the process is the large difference between the original size of the bubbles and their expanded size. Going from 60 nm to 6 mm is about 100,000 times larger, compared to the bubbles usually formed in sonoluminescence, which grow only about ten times larger before they implode.

"This means you've got about a trillion times more energy potentially available for compression of the bubbles than you do with conventional sonoluminescence," Taleyarkhan said. "When the light flashes are emitted, it's getting extremely hot, and if your liquid has deuterium atoms compared to ordinary hydrogen atoms, the conditions are hot enough to produce nuclear fusion."

The ultrasound switches on and off about 20,000 times a second as the liquid is being bombarded by neutrons. The researchers compared their results using normal acetone and deuterated acetone, showing no evidence of fusion in the former. Each five-ms pulse of neutrons is followed by a five-ms gap, during which time the bubbles implode, release light and emit a surge of about 1 million neutrons per second. In the first experiments, with the less sophisticated equipment, the team was only able to collect data during a small portion of the five-ms intervals between neutron pulses. The data clearly show surges in neutrons emitted in precise timing with the light flashes, meaning the neutron emissions are produced by the collapsing bubbles responsible for the flashes of light, Taleyarkhan said. ❑❑❑

ECLECTIC OBSERVER

Compiled by Eugene Mallove

NEC's "Fastest Rechargeable Battery"

April 2, 2004 (TOKYO)— NEC Corp has developed a battery that can be recharged only in 30 seconds, company sources said. Called an organic radical battery, it can be recharged to the same level of power as that stored in nickel-hydrogen cells, which are widely used in digital cameras, portable MD players and other electronic devices.

It takes only about 30 seconds to recharge the battery enough to allow 80 hours of continuous operation of an MD player, compared with around an hour needed by conventional rechargeables, the company claims.

Because of its ability to recharge faster, the new battery, which stores power in a special resin, is expected to make radio-controlled toy cars, shavers, and other products much more convenient to use.

The battery can also discharge power in a short time, making it useful in applications requiring a large amount of power. NEC believes the battery can be used as an emergency power source for computers in case of blackouts as well as in hybrid cars driven by gasoline engines and electric motors.

The company plans to convert existing production facilities into ones able to manufacture the new product. The company expects the price of the new battery to be about the same as nickel-hydrogen cells when mass production starts, since it does not contain any expensive materials.

NEC is also developing a recharger for the battery that can be used at home as well as working on a way to prevent excessive discharge of power from the cell. The company will initially try to commercialize the technology for using the battery as an emergency power source for computers, according to sources at NEC. (From: *The Nihon Keizai Shimbun*)

The Fuzzy Politics of ITER

BRUSSELS, Belgium (Reuters)— The European Union said on Tuesday it would be technically possible for Europe to go it alone in building the $12 billion International Thermonuclear Experimental Reactor (ITER) if Japan beats France to the international contract. The two countries have bid for ITER and Paris has said Europe could go on its own if a multinational joint venture decided to give the contract to Japan. A European Commission spokesman said it was technically and scientifically possible for Europe to build the reactor itself, as suggested by French Prime Minister Jean-Pierre Raffarin on Monday, but he also highlighted the costs of building ITER. "It is not impossible, but is of course a significant amount of money," Commission research spokesman Fabio Fabbi said. The United States, in a move seen in Paris as a bid to punish it for opposing the U.S.-led war in Iraq, has backed the remote northern Japanese fishing village of Rokkasho as ITER's site against Cadarache, near Marseilles in southern France. The six members of the ITER joint venture failed in December to agree on a site with the United States and South Korea backing Japan, while China and Russia favor the French site. The decision, which is to be taken by consensus, was postponed until mid-February after an evaluation of the sites. Fabbi told a daily news conference that if a consensus was reached in favor of Rokkasho, the EU would accept the decision. But he added that the bloc continued to believe that Cadarache was the better site for the project. Japan's science minister plans to visit South Korea, Russia and China this week to seek backing for Tokyo's bid. France has suggested the project could be split in two, with the reactor in Cadarache but data analysis elsewhere.

"Bubble Fusion" in *Physical Review*

Two press releases on this very significant work on sonofusion were received from Rensselaer Polytechnic Institute and Purdue University. The researchers are evidently of the opinion that they are creating mini-*hot* fusion at the center of collapsing bubbles in deuterium-containing liquid. There remains controversy about the mechanism that is causing this kind of apparent fusion. Some theorists in the "cold fusion" field want to associate these effects with LENR reactions, others do not. The jury is still out. Certainly no one can say for certain what the temperature at the core of a collapsing bubble really is to know what kind of fusion is most likely. We are happy that work that originally appeared in *Science* amid great controversy (see earlier story in *IE* #43, pp. 8-11) has now made it to *Physical Review*. Here is our re-write of the two press releases from early March 2004, combining the two to eliminate redundancy:

Researchers Report Bubble Fusion Results Replicated

Evidence bubbles over to support tabletop nuclear fusion device

Physical Review E has announced the publication of an article by a team of researchers from Rensselaer Polytechnic Institute (RPI), Purdue University, Oak Ridge National Laboratory (ORNL), and the Russian Academy of Science (RAS), stating that they have replicated and extended previous experimental results that indicated the occurrence of nuclear fusion using a novel approach for plasma confinement. This approach, called bubble fusion, and the new experimental results are being published in an extensively peer-reviewed article titled "Additional Evidence of Nuclear Emissions During Acoustic Cavitation," which is scheduled to be posted on *Physical Review E's* website and published in its journal this month.

The research team used a standing ultrasonic wave to help form and then implode the cavitation bubbles of deuterated acetone vapor. The oscillating sound waves caused the bubbles to expand and then violently collapse, creating strong compression shock waves around and inside the bubbles. Moving at about the speed of sound, the internal shock waves impacted at the center of the bubbles causing very high compression and accompanying temperatures of about 100 million K.

These new data were taken with an upgraded instrumen-

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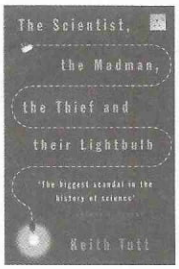
About the Author

Ken Rauen resides in Palo Alto, California, and is presently a research scientist for Clean Energy, Inc., preparing a version of the Papp Engine for commercialization. He remains a consultant to New Energy Foundation.

*E-mail: ken.rauen@sbcglobal.net

The Scientist, the Madman, the Thief, and Their Lightbulb

by Keith Tutt



This is the U.S. release of the book originally titled *The Search for Free Energy*. Tutt presents the many new energy/free energy inventors of the past 100 years, from Nikola Tesla, to Stanley Pons and Martin Fleischmann, to Randell Mills and Alexandra and Paulo Correa; the book includes two chapters on the cold fusion field and its researchers.

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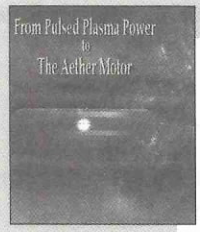

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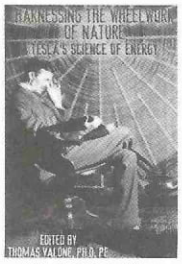
Harnessing the Wheelwork of Nature: Tesla's Science of Energy

Edited by Thomas Valone



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33. A classical argument is created by the hypothetical existence of a super-Carnot engine. If such a device were paired with a Carnot heat pump between the same heat reservoirs (high and low temperature) connected to the super-Carnot heat engine, and that engine provided the work to operate the Carnot heat pump, the net result would be either net work produced from an equivalent amount of heat taken from just the low temperature reservoir, or the transport of heat from the low temperature reservoir to the high temperature reservoir with no other flow of energy to or from the engine and heat pump pair. Since neither of these two results have been observed and are considered to be absurd, it is supposedly proven that Carnot cannot be exceeded. "Absurdity" or lack of evidence are not the same as impossibility. Likewise, an apparent lack of manifestation of a phenomenon in nature is not a legitimate argument for its impossibility; absence of evidence is not evidence of absence. Closed cycle heat engines are apparently unknown in nature, yet man-made closed cycle engines and heat pumps abound on our planet today, countable in the millions. The conclusion drawn in the classical argument is incorrect, due to flaws in the application of logic.
34. This is as close as the author gets to stating an impossibility. If anyone claims to have omniscience, the author can merely ask that person what the author ate for breakfast the day before. If that person cannot answer the question correctly, that person is not omniscient. The author is more certain of a lack of omniscience in any human being than the Scientific Community is certain of the universality of the Second Law.
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as a whole has an efficiency exceeding Carnot, despite reversed biased junctions which normally make a TEG Carnot-limited.[64-69] Yater plays with words in order to "pander" to United States Patent and Trademark Office administrative policy regarding "perpetual motion machines." He states high electron temperatures for the energy input of his devices, and states normal, truly thermal temperatures for the heat output side, in order for his devices to conform to Carnot; this is a false Carnot efficiency, as true input side temperature is not considered, just like electromagnetic input energy of a solar cell has no thermal nature as normally understood. To quote Yater,

> In general, the utilization of quantum effects in absorbing radiation in the first layer of the REF [reversible energy fluctuations] converter can enable a higher total efficiency to be achieved than that of the Carnot cycle between the temperature of the lattice of the first layer and the temperature of the cooler rectifying layer.[70]

See the author's deeper treatment of Yater's unique TEG concepts.[71]

Nobel Laureate Ilya Prigogine has clarified misunderstandings about the nature of irreversibility, a driving concept for the traditional understanding of the Second Law.

> Boltzmann's probability-based interpretation makes the macroscopic character of our observations responsible for the irreversibility we observe. If we could follow the individual motion of molecules, we would see a time-reversible system in which each molecule follows the laws of Newtonian physics. Because we can only describe the number of molecules in each compartment, we conclude that the system evolves toward equilibrium. According to this interpretation, irreversibility is not a basic law of nature; it is merely a consequence of the approximate, macroscopic character of our observations.[72]

> The main reason to discard the banalization of irreversibility is that we can no longer associate the arrow of time only with an increase in disorder. Recent developments in nonequilibrium physics and chemistry point in the opposite direction. They show unambiguously that the arrow of time is a source of *order*.[73]

The manifestation of a physical law can be altered or superceded by other physical laws. The laws interact, and rarely do laws exhibit their behavior in pure form; this is why the protocols of laboratory experimentation are so demanding. Venturi's principle alters the effect of gravity in an airplane. Heat engines that have efficiencies higher than Carnot do not necessarily violate Carnot any more than an airplane violates gravity. The principles that can break the Carnot barrier coexist with Carnot just as gravity keeps an airplane from soaring into the stratosphere.

Not all interactions of physical principles are obvious. An example shows how unobviousness can lead to false predictions of a result. Pascal's principle states that when a pressure is applied to a confined fluid, the pressure equalizes over the entire fluid's boundary. Gravity also has an interaction here. The interaction of gravity and Venturi's principle is commonly obvious in the airplane, but the interaction of gravity and Pascal's principle in a pressure tank is not. In hydraulics, when the force created by gravitational acceleration is large enough, it appears as if Pascal's principle is violated because the typical prediction of equalized pressure in a vessel is untrue. In actuality, both principles coexist simultaneously.[74] The vertical pressure gradient in a municipal water tower demonstrates this.

Fuel cells that combust hydrogen, releasing the same chemical energy as burning hydrogen in internal or external combustion engines, have higher absolute conversion efficiencies than allowed by Carnot for the same maximum and minimum fuel cell temperatures. The same energy is released, yet a different set of conditions produces a different result. Carbohydrate metabolism in living organisms by enzymatic oxidation that produces motion by muscle contraction, and thus work, is not Carnot-limited for the same reason: the conversion process is not thermal, but is ΔG-driven.

By the preceding examples, it is presumptuous to require that one established physical "law" be the sole determinant of a physical outcome, that nothing else will alter the result. Since one physical law can supercede another, no law can be claimed to be absolute, in the sense that it can definitively predict a physical result. The unrelenting demand that the Second Law be applied under all conditions and with no exceptions is short-sighted and incorrect. The general observation of the phenomenon of one physical law asserting itself over another precludes the necessarily absolute manifestation of any law.

For a clearer understanding, the law of gravity is examined by itself. The law of gravity is accepted as universal. Despite this, no one concludes that all matter will agglomerate and that no matter will separate, having absolute manifestation. The common sense of such an understanding needs to be applied to the Second Law. Apparent exceptions will occur, not because the Second Law is invalid, but merely because other laws are active and interact for a composite result which may seem contradictory to a specific law.

There is at least one specific exception to the Second Law that is acknowledged and accepted within the scientific community. Negative absolute temperature in quantum mechanical systems has been well established. Heat can be extracted from a negative temperature reservoir with no other effect than the performance of an equivalent amount of work.[75]

Other exceptions are being debated within the scientific community.[76] Recent work in solid state physics aided by nanotechnology developments has proposed the possibility of the generation of work from a single, uniform temperature reservoir.[77]

All of these examples from conventional science and the preceding arguments, including the theoretical and experimental arguments for a macroscopic Maxwell's Demon in Issue #52, are provided as a basis for an open-minded examination that what has been known about the behavior of heat and entropy, as embodied in the Second Law of Thermodynamics, is incomplete.

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thermodynamics and quantum mechanics, each derivation arriving at the same equation.[45] This equation allows electrons to emit from a surface, which is a form of work, when the material is at one temperature. Though thermionic emission is commonly utilized with the presence of a second electrode that is at another temperature, that second electrode at another temperature is not necessary because the Richardson-Dushman equation contains only one temperature. If any materials at thermal equilibrium are identified as an isolated energy system, any thermionic emission of electrons would be a decrease in the system's entropy, which is a "violation" of the Second Law. Such behavior has been reported. Dr. Xu Yelin of China built a large array of cold vacuum tubes wired in parallel that exhibited voltage across a resistive load when the array was at thermal equilibrium, and a consistent DC voltage persisted for over five years.[46,47]

Poignant examples of unity efficiency are found within the heart of classical thermodynamics. Blackbody radiation is a unity conversion process; no heat must be wasted in order for thermal energy to be converted into electromagnetic radiation. Isothermal expansion of an ideal gas under reversible conditions has unity conversion of heat into pressure-volume work. The same is true for isentropic, adiabatic expansion, but also under irreversible conditions; the work is still produced from *only* the working fluid's internal energy. Though these processes are not complete engine cycles, the bounds of Carnot's Theorem seem inconsistent with these phenomena. Why can *single processes* be unity efficient transformations, yet *cycles* must not only be less than unity according to Carnot, but also less than a certain variable fraction? The Second Law definitely is not limited to cycles; it also includes single step, non-repeating phenomena, such as chemical reactions, making the cyclic requirement for sub-unity work generation even more inconsistent.

Carnot's Theorem applies to a cycle and denies unity conversion efficiency, yet thermodynamic processes do exist which are of unity efficiency. The incongruity of the existence of unity efficient one-way thermodynamic processes and the Carnot limitation for cycles has no other explanations than to conform to the Kelvin-Planck and Klausius Statements and to conform to the specific definition of the Second Law that the net entropy change of an isolated energy system must be zero or greater than zero. *The author proposes that this "requirement" of a cycle is only a hypothesis based upon experience to date and the generalized theoretical understandings of the Second Law.*

Carnot's Theorem has been shown to be not universally true.[48] It is based upon limited premises, plus there are faults in the logic of the arguments that established it so firmly in scientific "dogma." The result of these conditions is that universality is not a proper conclusion.

Second Law analyses of heat engine cycles sometimes involve a concept of work reservoirs, in addition to heat reservoirs. An engine device that expands and contracts, in contact with the surrounding atmosphere, gives work to and receives work from the atmospheric work reservoir. Such transformations are treated as perfect.[49] The atmosphere stores the work given to it thermally, along with gravitational potential, and gives it back in the form of work, perfectly. Air is known to dissipate acoustic energy as heat, and the mechanism is called molecular thermal relaxation.[50] Acoustic energy is a form of pressure-volume work. Since work is dissipated in the atmosphere and also returns work as a true work reservoir, work reservoirs contradict the common understanding of the Second Law that demands losses.

Charles Steinmetz, a contemporary and peer of Thomas Edison and Nikola Tesla, and a prominent engineer in the early days of General Electric, presented a mathematical argument that the Earth's atmosphere is a spontaneous heat separator, contradicting the Klausius Statement.[51] High kinetic energy atoms and molecules in the atmosphere can separate from the remainder of the atmosphere by escape velocity against the Earth's gravity, as a normal consequence of the wide range of particle velocities that occur at one temperature according to the Kinetic Theory of Heat. Steinmetz's adiabatic, First Law analysis[52] includes a plot of absolute temperature as a function of altitude; it predicts the atmosphere would reach absolute zero at 29 kilometers. Actual data shows a commensurate decline in temperature with altitude close to Steinmetz's calculations, but not only does the atmosphere *not* reach absolute zero at 29 km, it shows that the atmosphere has appreciable temperature beyond the zero point predicted by classical thermodynamics, *rising* in temperature above this altitude, exceeding the temperature of the surface of the Earth above 100 kilometers.[53] It is true that this temperature rise is at least partly due to high energy photon and particle absorption from solar and cosmic radiation. It is not sufficient evidence to constitute proof of spontaneous heat separation, but it is evidence nonetheless. The altitude of the temperature inversion also supports the spontaneous heat separation hypothesis, as only a miniscule fraction of atoms and molecules in the atmosphere would be significantly separated over long distances, those being the very high velocity ones, and this tiny fraction would thus skew the temperature only near the conditions where the vast majority of particles contribute next to nothing to the average kinetic energy, near absolute zero. The probability of this inversion altitude being due only to the absorption of radiation is small.

A forward biased thermocouple junction in a thermoelectric generator (TEG) or thermoelectric heat pump converts heat into electricity, demonstrating one polarity of the Peltier effect. This is the unity efficient conversion of heat into work. When examined as the cold junction of a heat pump, it becomes obvious that this conversion is unity efficient, as the cold junction has nowhere to reject any heat to; it is below the temperature of the environment it is in. A Second Law analysis of a thermocouple junction which converts heat into electricity shows that this isolated system has a net entropy change which is negative: heat is absorbed and thus the entropy change of the heat reservoir is negative, and that energy received by the junction is now electricity which is work and thus has no entropy. Electrical current enters and leaves the isolated system, but this is merely current and not energy. A cooling thermoelectric junction is an exception to the Second Law, coming from conventional science. Not only is it an exception under ideal conditions, it also occurs under common, every day, practical, irreversible conditions.

Joseph Yater developed substantial theories for a new type of TEG that conclude that Carnot can be exceeded in his devices.[54-63] The importance of his work is that individual junctions, which he calls quantum well diodes, are unity efficient in transforming heat into work, and if the energy input is non-blackbody electromagnetic radiation, the TEG

> a satisfactory manner; for it has shown that whenever living force is "apparently" destroyed, an equivalent is produced which in process of time may be reconverted into living force. This equivalent is "heat."[36]

"Living force" is Joule's term for work. Joule's statement contains a hint that he may have believed in more than what became the First Law. He may have believed in the *unity efficient* transformation of heat into work, in addition to his acceptance of energy conservation. Can there be any basis for the unity transformation of heat into work in contradiction to the Second Law? A further statement by Joule in the same document shows his belief in complete conversion more clearly:

> But the most convincing proof of the conversion of heat into living force has been derived from my experiments with the electro-magnetic engine, a machine composed of magnets and bars of iron set in motion by an electrical battery. I have proved by actual experiment that, in exact proportion to the force with which this machine works, heat is abstracted from the electrical battery. You see, therefore, that living force may be converted into heat, and that heat may be converted into living force, or its equivalent attraction through space. All three, therefore,—namely heat, living force, and attraction through space (to which I might also add "light," were it consistent with the scope of the present lecture)—are mutually convertible into one another. In these conversions nothing is ever lost.[37]

The meaning of his words is not perfectly clear, but there is a strong hint that he meant more than the mere conservation of energy; he was suggesting that the complete conversion of heat into work is possible. The key to understanding this is the "heat abstracted" in his example, which is heat removed from the environment through the battery. Why would Joule refer to this obscure energy flow as "the most convincing" if he were only referring to the conservation of energy, when his famous paddlewheel water heating experiment would surely be a more convincing demonstration due to its simplicity to observe and to measure? The author postulates that Joule *did* observe the unity efficient conversion of all of the heat flow into electrical work in the discharging battery and intended such in his statement. History has swept his apparent meaning away from this quotation.

An electrical battery can have a heat flow upon electrical discharge of its chemical energy, and this does not refer to resistance heating. The relationship is found in the Gibbs-Helmholtz equation,

$$\Delta G = \Delta H - T\Delta S, \qquad (3)$$

where ΔG is the Gibbs Free Energy change, ΔH is the enthalpy change, T is absolute temperature, and ΔS is the entropy change.[38] The discharge of the chemical energy represented by ΔG is work and entrains any heat that may be absorbed. The battery can only transmit ΔG by way of its electrical connections to its load. By the First Law, the heat must be accounted for, and it goes into ΔG. As Joule noted, nothing else happens to this thermal energy; it merely becomes work.

The electrolysis of water demonstrates this phenomenon in detail. Though it is not a "battery,"[39] it is a galvanic cell; work must be done on it to make it operate. The water electrolysis cell is often thought of as the opposite of a fuel cell. A fuel cell is a battery with inert electrodes and an external and potentially unlimited supply of chemical reactants. For one mole of liquid water, split into hydrogen and oxygen gas at 25°C and one atmosphere, the electrolysis energies are,

$$\Delta H = +285.58 \text{ kJ / mole, and} \qquad (4)$$
$$\Delta G = +236.96 \text{ kJ / mole.}^{40} \qquad (5)$$

The positive signs mean the energies are absorbed by the reactants undergoing change. Their difference, $T\Delta S$, according to the Gibbs-Helmholtz equation above, is the heat absorbed in the reaction,

$$Q = T\Delta S = +48.62 \text{ kJ / mole.} \qquad (6)$$

This is the unity efficient conversion of heat into chemical energy, which is potential energy and a form of stored work. When T is high enough, ΔG is zero and the heat required to dissociate water equals the absolute value of the heat of combustion of water, which is the heat of formation of water. This is the direct thermal decomposition of water, requiring no electricity.[41] It also is a demonstration of the complete conversion of heat into chemical energy, a form of stored work. The water electrolysis example is not a spontaneous conversion of heat into work, but clearly shows that heat can be completely converted into a form of energy that can be produced completely from work. In spontaneous, voltaic cells which are endothermic such as lead-acid batteries, absorbing heat upon discharge, heat is converted to a directly useful and desired form of work, electricity.[42-44] This is what Joule observed.

Examples of unity efficient energy conversion exist within well-documented and accepted phenomena. Photovoltaic cells, though only about 10% efficient with the solar spectrum with silicon semiconductor material, are ideally capable of unity conversion efficiencies with monochromatic radiation at their photoelectric potentials. Though photovoltaic cells are not heat engines, they nonetheless have unity efficient conversion under reversible conditions. Electric, magnetic, and gravitational fields are conservative, in conformance with the law of conservation of energy, the First Law of Thermodynamics. The energy transformations in these fields may not be thermodynamic (heat related) in nature, but all of these transformations demonstrate that one form of energy may be converted into another without some of the first energy being converted into heat. The only bearing these phenomena have in connection with entropy and the Second Law is the awareness that the proposed conversion of heat into work at unity efficient transformation is not without parallel in the physical universe. Waste is not necessary in energy transformations under all conditions.

The unity efficient conversion of heat into work is supported by the existing science of thermionics, and it occurs at uniform temperature. The Richardson-Dushman equation,

$$j = AT^2 e^{-\phi/kT}, \qquad (7)$$

is the basic equation of thermionic emission, where j is current density, A is a constant of the material emitting the electrons, T is absolute temperature, e is the base of naperian logarithms, ϕ is the material's work function, and k is the Boltzmann constant. The equation was derived from both

method are merely data and not conclusions, and the data are interpreted by our realities, the data's ultimate significance is questionable. By recognizing what a "law" is and how scientific "truth" is established, as just described, the laws of physics and scientific truth are inherently imperfect.

Just like any other law, the Second Law and its corollaries are inherently imperfect and therefore are susceptible to correction and amendment. There is evidence that the Second Law and its corollaries are incomplete or partly wrong, some of which were presented in the author's previously cited paper.[32]

An anonymous physics professor once said, "Light travels in straight lines, except when it is bent." This humorous, poetic statement contains much wisdom and is exemplary of the dynamics of knowledge in the realm of science. For those who are taught that light travels in straight lines, it is a truth for general life. It is not a statement of universal and absolute truth, as under certain circumstances light does not travel in a straight path. These exceptions are often obscure to the common person, even though they are within the realm of common experience: the effect of heat waves seen above the hot pavement of a long stretch of highway in the summertime, the twinkling of a star, or wavy images from under the surface of a swimming pool, which are also at an apparently strange location below the surface. The same thing applies to the science community, as scientists are human beings also. Humans have the characteristics of imperfect perception and limited consciousness. These attributes undermine the practice of science. Though science is a systematic method for gaining knowledge, and is of particular usefulness for understanding the physical universe, the practice of pure science as a supposedly *infallible* tool of learning is not within the realm of human experience. This is because, as far as we know, the human condition is inseparable from the practice of science. Our science not only needs correction and expansion as part of the growth process of life, but it also needs refreshment, reminders, and re-education. With this dynamic between the human condition and the scientific method in mind, the reader is admonished to be open to the possibility that science, as it exists today, is not in a state of completion nor a state of correctness. Life is more than a state of being; it is also a process of becoming.

Lord Kelvin

The Second Law, as it is accepted today, is comparable to the "light travels in straight lines" axiom. Nature is not so simple, and our laws may not be a full description of the natural phenomena. Maybe like light, heat can be "bent," showing a different manifestation than we were aware of. Besides, light seems to have a dual nature, both as a wave and as a particle, yet science still functions with this paradox.

Carnot's Theorem results from the application of the Second Law to energy transformations from heat into work. Engine efficiencies greater than stipulated by Carnot would have an isolated system net entropy decrease, and would "violate" or contradict the Second Law, plus violate the Kelvin-Planck and Klausius Statements.[33] Engine efficiencies approaching 100% without extremes of temperatures seem to be impossible.

Stating something is impossible, which is the same thing as stating that something does not exist, is illogical. In order for someone to state that something does not exist, that person must be able to examine everything that *does* exist to be sure that what is hypothesized does indeed *not* exist. This requires omniscience or all-knowing, and the author resolutely doubts that any human being has this capability.[34] Something might not exist, but we as human beings cannot be certain of that.

A negative hypothesis or conclusion has the same logical pitfall as the claim of an impossibility. It is based upon limited information and cannot be proven. All it takes to disqualify a negative claim is for one more piece of data or premise to be added, which can change the outcome. Two examples illustrate the point. If a negative conclusion is made from experience that water cannot remain a liquid if its temperature is below zero degrees Celsius (condition one) and the water is pure (condition two), a truth seems to be stated. Add a third condition of high pressure, and the negative conclusion with the two conditions becomes false; it is not universally true. The original conditions (the first two premises) are still true, but the conclusion is false. Everyone who has ice skated knows that if pressure is applied to the ice by the blades of one's skates, effortless gliding on the ice is possible. Liquifaction of the ice is what occurs. The second example of the fallacy of a negative conclusion comes from the science of nutrition. It has been common knowledge that vegetarians do not get enough vitamin B_{12} from their food. No known fruits and vegetables provide enough B_{12} for proper health, so it has been stated that vegetarians do not get enough B_{12}. Recent research has discovered that this is not true. Small populations of an obscure, indigenous, bacterial species in the small intestines of humans produce adequate B_{12} for good health in strict vegetarians.[35] Since one can never be sure that all possible conditions are identified (due to limited human consciousness), a negative hypothesis is not provable and a negative conclusion is invalid as a universal conclusion. It is illogical to state that something is impossible or that it does not exist.

The Second Law is not based upon a principle that universally precludes the possibility of the complete conversion of heat into work. The only principle at the foundation of the Second Law is what was stated at the beginning: heat flows to lower temperature. This principle does not contain a basis for a universal stipulation about heat engine efficiencies. A universal stipulation that prevents the unity efficient conversion of heat into work requires that all possible conditions be identified in order to exclude the unity conversion of heat into work. By the human factor mentioned before, omniscience is not available to bequeath legitimacy to such a claim; it is thus illogical to arrive at such a conclusion. Because all possible conditions are not knowable, a negative hypothesis cannot be proven, a negative conclusion is not universal, and a positive conclusion is subject to limitation despite being called "universal."

James Joule, the champion of the Kinetic Theory of Heat and a founder of modern thermodynamics, was a clear-headed proponent of the conservation of energy, which became the First Law of Thermodynamics. From his own writings he said,

Experiment has enabled us to answer these questions in

second law must either be founded on our actual experience in dealing with real bodies, or on the hypothesis that the behaviour of bodies consisting of millions of molecules may be deduced from the theory of the encounters of pairs of molecules, by supposing the relative frequency of different kinds of encounters to be distributed according to the laws of probability. The truth of the second law is therefore a statistical, not a mathematical truth, for it depends on the fact that the bodies we deal with consist of millions of molecules, and that we never can get hold of single molecules.[11]

Despite some founders' perspectives that the Second Law as described is not universal, absolute and insurmountable, interpretations of universality abound, and a smug attitude of certitude in the daily practice of science has replaced the actual mathematical uncertainty. One interpretation of the Second Law is the Kelvin-Planck Statement: "It is impossible to construct an engine that, operating continuously, will produce no effect other than the extraction of heat from a single reservoir and the performance of an equivalent amount of work."[12]

Another is the Klausius Statement: "It is impossible to construct a device that, operating continuously, will produce no effect other than the transfer of heat from a cooler body to a hotter body."[13]

The Kelvin-Planck and Klausius Statements are accepted as specific interpretations of the Second Law. Some scientists even *define* the Second Law by the Kelvin-Planck and Klausius Statements.[14-16]

Other comments from various sources are quoted to depict the general attitude regarding the Second Law:

Rudolf Klausius

"To date, no experiment has been conducted that contradicts the second law, and this should be taken as sufficient evidence of its validity."[17]

"The first law says you can't win; the second law says you can't even break even."[18]

"Each failure, each fraud exposed, established the laws of thermodynamics more firmly."[19]

"Extending mistrust of scientific claims to include mistrust of the underlying laws of physics, however, is a reckless gamble."[20]

"The conservation of energy would let us think that we have as much energy as we want, Nature never loses or gains energy. Yet the energy of the sea, for example, the thermal motion of all the atoms in the sea, is practically unavailable to us. In order to get that energy organized, herded, to make it available for use, we have to have a difference in temperature, or else we shall find that although the energy is there we cannot make use of it. There is a great difference between energy and availability of energy. The energy of the sea is a large amount, but it is not available to us."[21]

"The issue is not whether the second law of thermodynamics is valid in the ordinary world; nobody doubts that."[22]

"Maxwell's Demon is therefore no longer regarded as a limitation of the second law."[23]

"The second law of thermodynamics rules out the possibility of constructing a *perpetuum mobile* of the second kind. . .The experimental evidence in support of this law consists mainly in the failure of all efforts that have been made to construct a *perpetuum mobile* of the second kind."[24]

"To Gell-Mann, science forms a hierarchy. At the top are those theories that apply everywhere in the known universe, such as the second law of thermodynamics and his own quark theory.'"[25]

"Some authors argue that the universe is an isolated system and that, therefore, all processes in the universe cause its entropy to increase. The entropy of the universe tends to a maximum, and when that will have been reached, no processes will be possible. The universe will 'die' an 'entropy death.'"[26]

"This is the true significance of the term, *irreversible*. The state of the Universe can never be completely restored."[27]

"No exception to the second law of thermodynamics has ever been found—not even a tiny one."[28]

"As Albert Einstein put it, 'A theory is the more impressive the greater the simplicity of its premises, the more different kinds of things it relates, and the more extended its area of applicability. Therefore the deep impression which classical thermodynamics made upon me. It is the only physical theory of universal content concerning which I am convinced that, within the framework of the applicability of its basic concepts, it will never be overthrown.'"[29]

Even Rudolf Klausius took a universal view of the Second Law, doing so by decree:

Everything we know concerning the interchange of heat between two bodies of different temperatures confirms this, for heat everywhere manifests a tendency to equalize existing differences of temperature . . .Without further explanation, therefore, the truth of the principle will be granted.[30]

Max Planck, the founder of Quantum Mechanics, once said, "We have no right to assume that any physical laws exist, or if they have existed up to now, that they will continue to exist in a similar manner."[31]

What Max Planck meant is that our *understanding* of the physical principles which govern the universe are susceptible to change. A "law" is merely a statement of what we perceive of a physical principle; it is not the principle itself. Reality is what we realize. Our realizations are limited to our bodily senses, our thoughts, and our emotions. The scientific method was developed to assist the transcendence of our realities, which are well known to be imperfect, in an attempt to arrive at a knowledge of what "is," what the author calls "actuality." We cannot know an actuality; we can only know a reality. When a reality is based upon an objective (naturally occurring) and reproduceable source of information, we call that "science." Since objective data obtained by the scientific

The Second Law of Thermodynamics and the Psychology of Science

Kenneth M. Rauen*

The evidence for and explanation of fundamentally missing knowledge in thermodynamics, as presented in my paper "The Proell Effect: A Macroscopic Maxwell's Demon" in Issue #52 of *Infinite Energy*, create more than a stir about the scientific details. It also raises the issues of what science is and how it functions.

It is appropriate to begin by quoting the final comments of that paper:

> This paper stands in stark comparison to mainstream, conventional thermodynamics. Because of the facts it contains and the conclusions that are drawn from them, one wonders how thermodynamics got so far afield that an adjustment based on these recent findings will have to be so severe. Percy Bridgman, 1946 Nobel Laureate in physics, wrote his perspective on the historical acceptance of scientific developments in the introduction of his book, *The Thermodynamics of Electrical Phenomena in Metals*. It illuminates one source of error in science and a good reason for the shock that this paper will undoubtedly create: "The progress of physics is unsystematic. . .The result is that physics sometimes passes on to new territory before sufficiently consolidating territory already entered; it assumes sometimes too easily that results are secure and bases further advance on them, thereby laying itself open to future possible retreat. This is easy to understand in a subject in which development of the great fundamental concepts is often slow; a new generation appears before the concept has been really salted down, and assumes in the uncritical enthusiasm of youth that everything taught in school is gospel truth, and forgets the doubts and tentative gropings of the great founders in its eagerness to make applications of the concepts and pass on to the next triumph. . .But each new young physicist. . .is in danger of forgetting all the past rumination and present uncertainty, and of starting with an uncritical acceptance of the concepts in the stage of development in which he finds them."[1]

Bridgman could just as well have been talking specifically about the Second Law of Thermodynamics, instead of about physics and science in general.

To repeat for the clarity of the readership, the Second Law is often stated as: "Heat flows spontaneously from a hotter to a colder object but not vice versa."[2] It is most succinctly stated as, "When an isolated system undergoes change, its change in entropy will be zero or greater than zero."[3-6]

The Second Law may be mathematically reduced to

$$\Delta S_{net} \geq 0, \qquad (1)$$

where S is entropy.

Carnot's Theorem is a specific embodiment of the Second Law, describing the interaction of heat and work. It states that a heat engine's maximum efficiency of converting heat into work is the ratio of the absolute temperature change of the heat passing through the engine divided by the absolute temperature of the heat input,

$$\eta_c = (T_{hi}-T_{lo})/T_{hi}. \qquad (2)$$

This theorem is a specific expression of the Second Law, therefore Carnot efficiencies are considered to be as inviolable as the Second Law itself.

The Second Law is, however, merely a statement of the collective experience of observed phenomena and has never been proven.[7-9] The Second Law was not understood by all of its founders to be universal and absolute.

Willard Gibbs wrote, "The laws of thermodynamics may easily be obtained from the principles of statistical mechanics, of which they are the incomplete expression"—and Ludwig Boltzmann expressed similar sentiments.[10]

James Clerk Maxwell summed up his perspective of the limitations of the Second Law:

> It is probably impossible to reduce the second law of thermodynamics to a form as axiomatic as that of the first law, for we have reason to believe that though true, its truth is not of the same order as that of the first law. The first law is an extension to the theory of heat of the principle of conservation of energy, which can be proved mathematically true if real bodies consist of matter "as per definition" acted on by forces having potentials. The second law relates to that kind of communication of energy which we call work. According to the molecular theory the only difference between these two kinds of communications of energy is that the motions and displacements which are concerned in the communication of heat are those of molecules, and are so numerous, so small individually, and so irregular in their distribution, that they quite escape all our methods of observation; whereas when the motions and displacements are those of visible bodies consisting of great numbers of molecules moving altogether, the communication of energy is called work. Hence we have only to suppose our senses sharpened to such a degree that we could trace the motions of molecules as easily as we now trace those of large bodies, and the distinction between work and heat would vanish, for the communication of heat would be seen to be a communication of energy of the same kind as that which we call work. The

of G anisotropy contains two components: one, which drops with the distance to M, and another which is a constant, presumably caused by the masses asymmetrically located in the laboratory. The experimental setup allows us to make measurements only for a limited set of directions, so the measured level of G anisotropy of 0.054% is only a lower estimate for this effect. Further experiments must be performed in order to determine a precise value of G in different directions relative to the stars as well as at different magnitudes of the distance between the gravitating masses. The possible effect of close celestial bodies should also be investigated.

3. Post Scriptum

In their recent paper[24] C.S. Unnikrishnan and G.T. Gillies constrain the spatial variation of $\Delta G/G$ to be no greater than 10^{-10} based on the experimental data on variation of weight (gravimetric data) and on Lunar Laser Ranging (LLR) experiments. At first sight, this constraint drastically disagrees with the variation claimed in our work. Yet this disagreement exists only under the assumption that the gravitational anisotropy does not depend on the magnitude of the interacting masses and the distance between them. Without such assumption, the controversy disappears because the masses and distances in the experiments analyzed by C.S. Unnikrishnan and G.T. Gillies drastically differ from those in our experiment as well as in other experiments connected with G measurements. The hypothesis of distance dependence of G anisotropy was proposed several months ago by Robert D. Reasenberg in a discussion concerning our findings at the Harvard-Smithsonian Center for Astrophysics.

It is also necessary to clarify the questions concerning the period of G anisotropy mentioned by C.S. Unnikrishnan and G.T. Gillies. The experiment was carried out in Moscow. The orientation of the line connecting the test mass m with the source mass M was 36 degrees to the East of South (144° asimuth). It is easy to see that this line has the same direction relative to the stars only once per one rotation of the Earth. Therefore the observed signal has an expected frequency. We are grateful to C.S. Unnikrishnan and G.T. Gillies for their attention to our work and welcome further discussion.

Acknowledgements

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the axis O rotated with the Earth. Given the above setting, G anisotropy will make the results off G measurements change synchronously with the rotation of the Earth. If G anisotropy is connected with the system of fixed stars, then the value of G must be changing with the period of one sidereal day (23.93 hr). G was measured around the clock during a period of seven months. The time interval between two consecutive measurements of G was 1.1 - 1.2 hr for most (94.8%) data points. The measurements have been performed automatically, under constant temperature (23 ± 0.1°C) in a vacuum chamber (pressure = 10^{-6} Pa). The first method for identifying G anisotropy was spectral analysis of G measurements. Lomb's "least-squares frequency analysis of unequally spaced data"[21,22] was used in a computer program created by George B. Moody.[23] The result is a periodogram of G (Figure 2) which has a clear absolute maximum at the period of 23.89 hr. Given the precision of the method (± 0:06 hr), estimated by the width of the main spectral line, this period matches the sidereal day. The amplitude of the sidereal component corresponds to a 0.054% change in G with direction.

The second method of testing G anisotropy was developed in order to demonstrate that the observed variation is in fact connected with the gravitational force between the heavy mass M and the torsion balance rather than other factors. We call the second method "the antenna for G anisotropy." The method analyzed the amplitude of the sidereal component of the period T for different positions of the mass M. In the presence of G anisotropy, the force of attraction between M and the torsion balance should change with the rotation of the Earth. The period of oscillation of the torsion balance T will change accordingly. The magnitude of the variation of T, given M at a certain position, will depend on the force of attraction from the mass M. More precisely, the amplitude of T's sidereal component should be proportional to a factor Z, which is the difference between the inverse square of mean period of oscillation when M is at that position and when M is taken out. Other periodical factors (tidal effects, seismic vibrations, temperature, etc.) can in principle also affect the restoring torque of the fiber and thus the period of torsion balance. In contrast to the effect of G anisotropy, any small change in the restoring torque of the fiber will affect period in direct proportion to the value of the period T itself. Accordingly, the interfering periodic signals from these factors should be directly proportional to T. In our experiment, as M is moved into different positions, the value of T changes at a maximum of 3.2%. Thus the amplitude of the interfering signal should change by no more than 3.2% as we vary the position of M. An interfering signal should increase as the period T increases. We conducted spectral analysis of the measurements of torsion balance's period T for three different positions of the heavy mass M (Figure 3). The results are:

1. All the periodograms have a clear absolute maximum with a period corresponding to the sidereal day given the experimental error.

2. The amplitude of the "sidereal component" increases as the distance between the heavy mass M and the torsion balance decreases (Figure 4).

3. When M was moved from the farthest position to the closest position, the amplitude of the sidereal component of T increased by 63%.

4. The correlation coefficient between the sidereal component amplitude versus the factor Z is 0.99.

In other words, the experiment demonstrates that the torsion balance works as an antenna for detecting the G anisotropy signal, with the efficiency increasing when M is moved closer to the balance. The high correlation coefficient demonstrates that the observed effect is a result of the gravitational interaction rather than any other factors. The observed signal cannot be caused by factors which affect a restoring torque of the fiber. As stated above, an interfering signal should decrease by a maximum of 3.2% as T decreases; on the contrary, the observed signal increases by 63% as T decreases. The regression line in Figure 4 shows that the observed signal

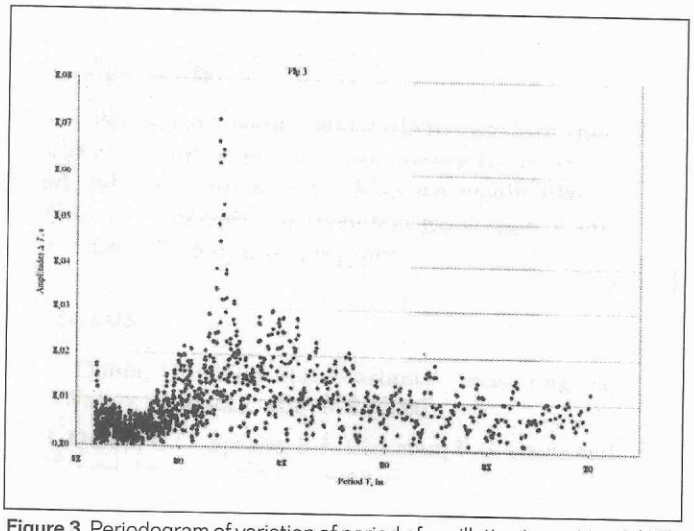

Figure 3. Periodogram of variation of period of oscillation in position 2 (ΔT), amplitude 0.0714 s at T=23.82 hr. Note: T in italics means that it is the period of oscillation, whereas T without italics is the period as a result of spectral analysis.

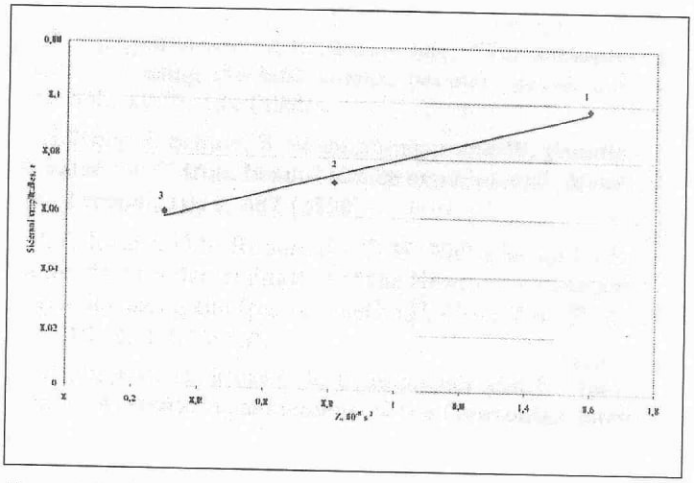

Figure 4. Amplitude of sidereal component ΔT in s versus factor Z in 10^{-8} s^{-2}: 1: position 1, Z=1.595 x 10^{-8} s^{-2}, amplitude ΔT=0.0980 s, distance from M to m 6.7406 cm, T=23.80 hr, T_1=2001.245 s; 2: position 2, Z=0.813 x 10^{-8} s^{-2}, amplitude ΔT=0.0714 s, distance from M to m 8.7381 cm, T=23.82 hr, T_2 =2033.354 s; 3: position 3, Z=0.298 x 10^{-8} s^{-2}, amplitude ΔT= 0.0604s, distance from M to m 12.7357 cm, T=23.84 hr, T_3=2055.357 s, T_0=2069.569 s - period of oscillation without mass M, $Z=T_i^{-2} - T_0^{-2}$ (i–1,2,3), correlation coefficient r=0.9932, square of correlation coefficient r^2=0.9864, Least-Square Linear Regression Line y=a+bx, a =0.05, b=2939017.

Experimental Evidence That the Gravitational Constant Varies with Orientation

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Abstract

In 1687 Isaac Newton published the universal law of gravitation stating that two bodies attract each other with a force proportional to the product of their masses and the inverse square of the distance. The constant of proportionality G is one of the fundamental constants of nature. As the precision of measurements increased, the disparity between the values of G, gathered by different groups, surprisingly increased.[1-15] This unique situation was reflected by the 1998 CODATA decision to increase the relative G uncertainty from 0.013% to 0.15%.[16] Our repetitive measurements of the gravitational constant show that G varies significantly with the orientation of the test masses relative to the system of fixed stars. The distances between the test masses were in the decimeter range. We have observed that G changes with the orientation by at least 0.054%.

1. Introduction

The gravitational constant G is historically the first constant in physics, yet its degree of uncertainty is higher than for any other fundamental physical constants. Different groups of experimentalists obtained conflicting results for the exact value of G.[1-15] This situation caused CODATA to increase the relative G uncertainty from 0.013% to 0.15%.[16] Most scientists believe that the high degree of uncertainty of G is a result of experimental errors. Another possible point of view is that the high disparity in measured G values requires a revision of Newton's law of universal gravitation. This idea was expressed in 1988 by two of the authors (M.L. Gershteyn and L.I. Gershteyn). The authors published the "Attractive Universe Theory" (AUT), which predicted that the gravitational force between two bodies depends on the distribution of matter in the surrounding Universe.[17,18] Therefore, G is a variable depending on the orientation of gravitating bodies with respect to the system of fixed stars and could be affected by the position of close celestial bodies. The dependence of G on the direction in space has been named G anisotropy. The Attractive Universe Theory suggested that G anisotropy is the main cause of the disparity in high precision G measurements. It is necessary to note that G anisotropy on a much smaller scale (0.00002%) was proposed by Will based on Whitehead's Gravitational theory.[19] Also, K.P. Staniukovich proposed to consider G as a tensor rather than a constant value.[20] O.V. Karagioz and his co-authors observed that the measured G values vary with time.[13] In 2001, the authors of this paper developed a strategy for checking the predicted G anisotropy by gravitational experiments conducted in Moscow under supervision of one of the authors (O.V. Karagioz). We have detected G anisotropy by two independent methods. The measurements show that the level of G anisotropy is not less than 0.054%.

2. Measurement Procedure and Testing G Anisotropy

The experiment used a dynamic torsion balance to measure G (Figure 1). The dynamic torsion balance consists of two masses (m = 0.942 g) connected by a rod which is suspended by a thin fiber. The torsion balance was then set into oscillatory motion in a horizontal around the equilibrium axis O. A heavy mass (M = 4287.347 g) was placed on O, near one end of the torsion balance and affected the period of oscillation. The heavy mass M was moved along the axis O to different distances from the torsion balance, causing the period of oscillation T to change; this change determined G. The amplitude of the angular oscillation of the torsion balance was rather small (1.6 - 3.1°). The entire mechanism was set on the floor. Thus

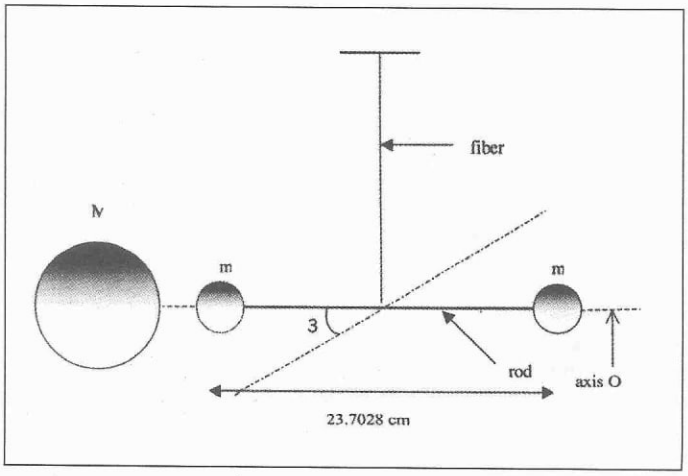

Figure 1. Schematic of a dynamic torsion balance.

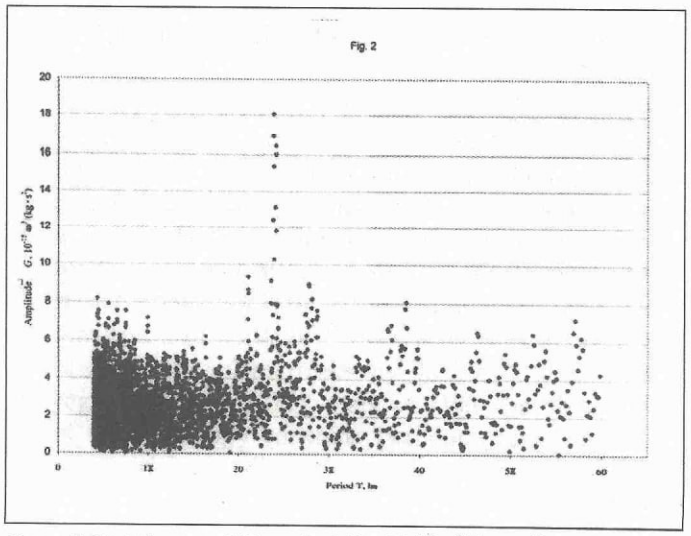

Figure 2. Periodogram of G , y-axis: ΔG in 10^{-15} $m^3/(kg \times s^2)$, amplitude 1.8 x 10^{-15} $m^3/(kg \times s^2)$ at T = 23.89 hr.

regenerating electricity in a way which defied the Carnot criterion. I now know that heat in its passage outwards through the magnetic field in a transformer core lamination was inducing an EMF which caused current to flow that was effective in augmenting the applied magnetizing field. In effect, under the specific control conditions I was using, this elevated the effective magnetic permeability of the core almost to the point of instability, making it so large that the eddy-currents induced were governed by an enormous amount of so-called "skin effect," the flux density being greatly distorted across the core cross-section. This means excess loss—all because heat energy has a way of converting back into electricity, in defiance of the second law of thermodynamics.

Thirty years on from my early university research years I retired from my professional vocation in industry and resumed my academic research, having in those years been ever active on my hobby interest in theoretical physics, though lacking enlightenment as to what has now come to be known as "free energy."

However, I then engaged in certain experimental projects and found, with time, that I was drawn into the "free energy" fray, magnetism being the route I was exploring, but by initial contact with others I was diverted into a thermodynamic project and distracted by the advent of cold fusion all about the same time 1988-1989, not to mention warm superconductivity, which I saw as another story of heat energy regenerating electricity and reaching a breakthrough threshold in enhancing current flow. It was that thermodynamic diversion that gave me the answer I needed to satisfy the hangover problem from my Ph.D. research, whereas the magnetic theme led me on to motor research, including a homopolar type of motor, the latter revealing an anomaly that has bearing upon something I wish to tell you that bears upon the capacitor power generation theme.

Now, much but not all of these efforts have been reported in a series of Energy Science Reports that I published. They all may be read by accessing my website www.aspden.org in which I plan to concentrate records of my work. There is even one such Report, No. 10 in the series, that may seem a misfit in the collection. It is entitled "Cyclotron Resonance in Human Body Cells." It bears upon the claims that overhead power lines can affect the health of those who live nearby, a theme which has now diverted into concern about the use of mobile phones. I mention it here because scientists find it hard to accept that 50 Hz or 60 Hz electromagnetic radiation can be harmful, whereas they are open minded on high frequency radiation. The overhead power line concern can be met by increasing the use of d.c. transmission, seen anyway as more economic for high voltage transmission. So if, as I believe, the ultimate in power generation is the capacitor technology discussed above, then power houses operating with well-spaced power lines at a 100,000 Hz frequency might arouse concern for those who live nearby, whereas its d.c. conversion for transmission would overcome the more general concern.

In summary, therefore, there is much that I have to relate in my onward account of the topic raised here, essentially the details of two experiments that help to confirm what I have proposed, and I shall report on these in the near future.

About the Author

Dr. Aspden graduated in 1948 with first class honors in Electrical Engineering (Manchester University, England) and, after two years shop-floor training with a major heavy electrical machine manufacturer (English Electric), spent three years on Ph.D. research (Cambridge University, England) investigating an anomalous magnetization energy loss in electrical steel laminations. After a further six years with English Electric specializing in protecting the company's inventions in the energy field, Dr. Aspden became IBM's Patent Manager in the U.K. and, in 1963, was promoted to head of IBM's European Patent Operations. During these years he maintained an active hobby interest in energy science (including aether theory and gravitation), published books, and struggled to get his papers in that field accepted in the face of hostile resistance. As a European Patent Attorney, he played a major role on the international patent scene during the years leading to the European Patent System. He is a past president of the Trademarks, Patents, and Designs Federation in U.K. and for five years had an official capacity in representing the International Chamber of Commerce at inter-governmental meetings concerned with intellectual property issues. In 1983, at the age of 55, he severed his patent connections, and voluntarily took early retirement from IBM, albeit with their sponsorship in his move back into academia as a Visiting Senior Research Fellow at Southampton University, England.

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Dr. Eugene F. Mallove
President, New Energy Foundation, Inc.

between the particles and continuum being the speed of light.

The Effect of Aether Rotation

Consider what happens when a large volume of the aether is rotating bodily. The continuum and particle system rotate together. There will be no resultant magnetic moment unless the particle distribution is disturbed. An evident disturbance is the centrifugal effect arising from aether rotation, but for the angular velocities of magnitude found in the solar system this effect is of negligible consequence. A much more important effect arises from the synchronizing interaction between particles in the rotating volume. This requires that the particles shall move about their neutral points at the same angular velocity. Thus if a particle is to have a velocity component V directed in the plane of its orbit, whilst retaining a mean velocity c/2, its speed along its orbit must be of the form $c/2+V\cos\theta$, where θ is the angle subtended by a line joining the particle and the center of its orbit relative to a fixed reference datum in the inertial frame. To satisfy the above requirement the center of the orbit cannot be the neutral point. Evidently the particle is distant from this neutral point by $r+(2Vr/c)\cos\theta$. As V is much less than c the effect of this is that the particle is moving around a circular orbit whose center has been displaced a distance 2Vr/c perpendicular to V in the plane of the orbit. If V is much less than $\varpi x\cos A$, where ϖ is the angular velocity at which the aether rotates, x is the distance of the aether particle from the axis of rotation, and A is the angle of tilt of the axis to the common axial direction of the aether particle system, this displacement distance is $2(\varpi xr/c)\cos A$. Consider a disc-like section of the rotating aether of radius x and unit thickness. Then, the effective charge displacement arising from the effective physical displacement of the particles is $2\pi x\sigma(2\omega xr/c)\cos A$. The disc has acquired a uniform charge density of $4(\omega r\sigma/c)\cos A$ esu/cc. The polarity of this charge depends upon the direction of rotation of the aether.

When evaluated from the aether data already presented the charge density is found to be:

$$4.781\ \omega\cos A \text{ esu/cc.}$$

This charge density represents a charge component which rotates with the aether.

Calculation of the Geomagnetic Moment

For Earth, ω is $7.26\ 10^{-5}$ rad/sec and A is 23.5°. Thus the Earth's charge density is, from the above expression, 0.000319 esu/cc. The rotation of this charge gives rise to a magnetic moment of:

$$(0.000319)(4\pi/15)\omega R^5/c$$

where R is here the radius of the Earth's aether. If R is greater than the Earth radius ($6.378\ 10^8$ cm) by a small factor k, the Earth's theoretical magnetic moment becomes $(1 + 5k)6.8\ 10^{25}$ emu. This may be compared with the measured value of the Earth's magnetic moment of $8.06\ 10^{25}$ emu.

An upper limit of 0.035 is imposed on k, suggesting the Earth's aether terminates at a mean height of about 140 miles above the Earth's surface. This suggests that the ionosphere may be a phenomenon arising at the aether boundary.

[End of quotation]

Note: The term σ used in the above Appendix denotes charge density of the positive charge continuum which provides the background medium of the aether, this being neutralized overall by the discrete charge forms which define the structure assuring the synchronized state of motion that characterizes the aether's role as a regulator in quantum physics.

I have used the word "aether" and make no apology for my seeming ignorance of the fact that physicists in general dare not engage in speculation about its properties for fear of ridicule. I well remember first reading one such apology some 56 years ago when, as a student, I purchased a book entitled *Classical Electricity and Magnetism* by Abraham and Becker, published by Blackie & Sons Limited, a translation from the German 1932 edition. It reads:

> Instead of the word vacuum we occasionally use the word "aether," not connecting it in any way with the idea of a hypothetical substance, but merely using the word when we are speaking of space as the carrier of an electromagnetic field.

This was a way of saying that instinct had caused them to err in using the word "aether" on occasion in their compilation of the book's onward instruction, not a good example for a physics student reader. I certainly did not allow such authority to influence my belief in a real aether. Given that energy can be stored in that "hypothetical" substance that sits between the plates of a charged capacitor, and recovered for use when needed, the aether must exist, though ill-founded arbitrary hypotheses as to its form and properties can, of course, be challenged. Our quest on the "free energy" front is to learn about it by fathoming the truths evident from experiment and discovery which have bearing on its real existence.

Fifty Years On

Fifty years on from now it seems possible, as I see it, for the capacitor technology discussed above to be the world's primary source of electrical power. Each cubic foot of space in what I may describe as the Capacitor Power House could account for the generation of 10 kw of power delivered as 50,000 V d.c. output, based a charge oscillation frequency of the order of 100,000 Hz.

This, however, assumes that history will not repeat itself, bearing in mind that the year 2004 is fifty years on from that 1954 demonstration of Lee Bowman's machine, which is now dead and buried and virtually forgotten, not to mention the ghost stories, for such they may seem, that keep our interest in Tesla and Moray alive.

For my part, I can only speak from my experience, based on the fifty years I have lived since being awarded my Ph.D. in that year 1954 for research on magnetism in connection with an energy loss anomaly that affects power transformers. By my research I discovered that I could trace factors affecting the anomaly and enhancing it so that as much as a factor of 6 represented the ratio of the actual loss to the value which electrical theory predicted as eddy-current loss. I could not really fathom the true cause at the time, because, in proper scientific spirit I had been well educated into believing that perpetual motion is impossible and accepting the laws of thermodynamics. It did not occur to me that much of the heat I was generating in the iron cores I was using could actually be

which are supported by strong evidence in that book *Physics Unified*, once such a notion is conceived it surely has to be put to the test by experiment.

This then, after decades of effort before this realization has dawned, is the basis on which the applicant has only now come to appreciate the amazing technological possibilities that lie before us and is asserting by this patent specification that energy can in fact be tapped from the aether on a commercially viable scale.

Given that aether theory indicates that the special form of capacitor described above will, if subject to an oscillatory charge condition, generate an excess of energy, a question to consider is why such a phenomenon has not manifested itself in bench-type experiments performed in numerous electrical laboratories over the past one hundred years. Ostensibly the implication is that the capacitor will exhibit a negative resistance if used with an inductor as a component in what would become a self-resonating circuit. The answer to this may be that if such a phenomenon has occurred it has passed unnoticed or been regarded as spurious or noise-related, being something connected with radio interference, etc. Alternatively, and as a function of the size and scale of the apparatus, the effect may have lacked an exciting trigger needed to overcome an energy threshold set by such factors as circuit contact resistance or contact potentials as well as the basic resistance of the inductors which, with the capacitors, form the resonant circuit.

Note that, even for a capacitor of quite large physical dimensions, having regard to its accommodation on top of a laboratory bench, the actual capacitance is necessarily quite small, being of the order of a billionth of a farad. This means that a capacitor charge fluctuation of the order of a volt would only imply energy fluctuations that are of the order of a billionth of a joule per cycle. The situation is quite different if, perchance a d.c. bias voltage of, say, 5,000 volts is applied to the capacitor. Then a small superimposed voltage fluctuation makes the related energy fluctuations very much larger with much greater prospect of an escalating self-resonance being triggered.

With this in mind the applicant perceived a possible prior art link with the experimental claims reported by Dr. Moray, who in 1929 is said (see pages 46-50 of the above-referenced recently-published book by Keith Tutt) to have powered six 100 watt light bulbs plus a standard 575 watt electric flat iron, merely by providing an earth connection and coupling an input lead to an overhead wire antenna. The apparatus involved had no other source of input power but included a special arrangement of capacitors and presumably some kind of high frequency inductor/transformer unit.

In spite of the attention given to the Moray demonstrations it seems that the secrets involved in the design and construction of the apparatus remain unknown and so cannot feature in the prior art of published record. Nor, indeed, can the anecdotal evidence of Moray's efforts serve to show that the subject invention has been put to prior use. The technology as to how to replicate the Moray device, always assuming it did perform as claimed, has therefore to be rediscovered and, indeed, given that there is reference to his detectors incorporating some special substance which was referred to as "Swedish stone," possibly the dielectric he used in his capacitor construction, there is a considerable mystery to unravel. More to the point, however, one is led to believe that Moray was implying that the energy he was tapping was radiant energy drawn from the aether, with that antenna featuring prominently because, without it being connected, the energy output fell to zero. However, as he surely may well himself have known, one just cannot draw power on such a scale from a simple overhead wire strung between two poles and so, without know-how, he would have suspected that the energy inflow was coming into his capacitors via the action of that mystery substance he called "Swedish Stone."

The applicant here suggests that, based on an insight into the quantum workings of the aether medium as outlined above, the curious discovery demonstrated decades ago by Dr. Moray may have been attributable to setting up an oscillation in a resonant circuit including a concentric cylindrical electrode capacitor which had a voltage bias of the order of a thousand and more volts fed from a connection to that overhead antenna but drawing no significant current from that antenna other than enough to prime his capacitor with charge and stimulate a high frequency fluctuation which could initiate an escalating circuit oscillation tapping aether energy from the aether spin induced in the capacitor dielectric.

This is speculation, but it is sufficient to justify the applicant's interest in constructing a capacitor and seeking to verify the assumptions just made.

Notwithstanding the reference above to Dr. Moray and the note below concerning Nikola Tesla, what it leads to is new invention by virtue of full disclosure of details of operation and manufacture of something hitherto unknown, the actual means by which to harness a source of energy latent in the aether medium and deemed by those familiar with state of the art knowledge to be beyond man's reach. Furthermore, there are supplementary inventive features of a special nature because of the way the subject invention exchanges energy between two capacitors and also because the optimization of aether power output from the capacitors is found to be a function of the orientation of the capacitor axes relative to the cosmic background owing to the Earth's rotation.

It seems here appropriate to mention something described by Nikola Tesla in his U.S. Patent No. 685,958. This was filed on 21 March 1901 and granted on November 5, 1901. It was entitled: "Apparatus for the Utilization of Radiant Energy." By installing two metal plates, one high above the ground and the other at ground level, with wires connecting the plates to separate electrodes of a capacitor, it was stated that the capacitor became charged to a very high potential, the energy input being that radiated to Earth from outer space. This may well have motivated the efforts of Henry Moray, but, so far as this applicant's invention is concerned, no such input from overhead components is necessary, as a quite different energy source is at work, namely the zero-point vacuum energy activity of our quantum underworld.

Appendix

Extract from pp. 30-31 of "The Theory of Gravitation," 1960 printed publication by the applicant. Note that the earlier pages explained that the aether comprises a system of electric particles in a cubic crystal-like distribution set in a uniform background continuum of opposite charge polarity, the particle system and the continuum both sharing a common circular orbital motion of radius r and the relative velocity

cially the case here where one is claiming a source of energy hitherto unknown. The invention to be described below will, in its broadest sense, appear to be quite similar to what Henry Moray is said to have demonstrated in showing that substantial electrical power could seemingly be drawn from the aether using a simple wire antenna strung between two poles. However, as will be seen, the antenna is not needed and the reason is that the energy source is not the radiant emission by some process involving radio wave propagation through the aether, but rather what can best be described as a phase-lock that couples the apparatus with the quantized motion of electric aether charge. There is a technique, to be described below, by which it is possible to exploit this phase-lock condition by setting up an energy oscillation involving an apparatus component and its enveloping aether, the result being that energy in an immediately useful electrical form is imported into the apparatus from that aether.

The invention draws energy from the aether. To understand why the invention works one needs to understand the process by which the aether stores energy when an electric field is set up across the dielectric separating two capacitor plates. Moreover, one needs to understand the means by which the aether determines the quantum of action, specifically in the form of the Bohr magneton and the unit of angular momentum linked to Planck's constant.

It is not sufficient to imagine that electric charge in the aether is displaced from a rest position in a background continuum of opposite charge polarity to which it is attracted by a restoring force. Indeed, one must consider such action to be superimposed on a system of charge that has an underlying jitter motion, a quantum theory theme associated with the German physicist Heisenberg (Zitter-bewegung, which has the dictionary meaning "circular fluctuation movement, of spin"). When these two factors are combined, and the constraint added of there being a phase-lock which keeps that jitter motion in synchronism as between the charges, one finds that the physical theory involved has some very interesting consequences.

One of these consequences is that a spherical or cylindrical volume of aether, if spinning bodily about a central axis, will acquire a magnetic moment and set up an electric field inside that sphere or cylinder that is directed radially with respect to the spin axis. A summary analysis is presented in the Appendix to this specification, being in part a quotation from pages 31-33 of a booklet entitled "The Theory of Gravitation," which the applicant of this invention, Dr. Harold Aspden, authored in 1959 and duly published early in 1960.

The induction of electric charge by "aether spin" was there shown to give a physical basis, both qualitative and quantitative, for the geomagnetic moment, the property of body Earth of setting up a magnetic field which created magnetic North and South poles at latitudes offset from the geographic poles, with the geomagnetic polar axis precessing slowly around the Earth's spin axis at a rate of several hundred years per revolution. By identifying its source as a rotation of a sphere of aether coextensive with body Earth, a volume of aether relative to which the Earth could have a component of motion even though the aether spin frequency is equal to that of the Earth, this axial tilt of some 17 degrees has a physical explanation. However, that aspect of the aether's role was not seen at the time as offering anything of promise technologically. The physics involved is nevertheless very relevant and directly pertinent to the experiments on which this invention is based, the findings of which would otherwise be quite baffling scientifically.

The applicant has, over the forty or so years since the theory was first published, given a great deal of consideration to the theoretical implication that, just as aether spin can set up electric charge displacement inside coextensive matter, so the setting up of an electric field directed radially with respect to an axis can induce aether spin about that axis and with it develop angular momentum. Indeed, in the author's onward publications on this subject, as, for example, *Physics Unified* published in 1980 (Sabberton Publications, P.O. Box 35, Southampton, England, ISBN 0-85056-0098), it is shown how the onset of the force of gravitation when a disordered aether consolidated into an orderly structured form caused protons to accrete more rapidly than electrons, owing to their higher mutual rate of gravitational acceleration. This created stars with an initial positive charge and the associated aether spin resulted in the stars acquiring their spin states and shedding matter which consolidated into planets which share the angular momentum so generated. The aether with its property of spin as related by its electric charge density according to the formula presented in the Appendix is therefore the key factor if we attempt to account for the creation of the stars which populate our universe.

That same formula, however, is equally valid if applied to the circumstance where a radial electric field is set up between the concentric cylindrical electrodes of a capacitor formed around a hollow dielectric cylinder. It tells us how fast the aether within that dielectric will spin. The related theoretical analysis shows that the quantum phase-lock feature of the aether imports from the external aether world an amount of energy equal to that supplied in setting up aether charge displacement, this imported energy being the dynamic energy corresponding to the acquired aether angular momentum. Guided by the argument concerning stellar creation, one can see that this aether angular momentum can be transferred to matter and this process also has its energy transfer implications.

However, one can wonder what happens if, after setting up a radial electric field in that capacitor having concentric electrodes, the applied voltage is reduced, thereby withdrawing electric field energy from the capacitor. The imported energy present in kinetic energy form as a cylindrical shell of aether spins about the central axis of the capacitor will tend to sustain electric charge displacement. To conserve energy, since the aether phase-lock cannot force the expulsion of energy by obliging the enveloping aether universe to keep in step, this energy can only be shed by augmenting that released electrostatically. In other words the net result is that an up and down fluctuation of the electric charge condition of the capacitor must give rise to an electric energy output that is, for the lowest dielectric constant (the permittivity of the vacuum), double the input in each cycle of change. One can then envisage an oscillation escalating in energy content powered almost wholly by aether input before one taps into that source of power to draw off energy at a rate consistent with stable operation.

This is, of course, a bewildering prediction that no physicist could imagine as being at all possible and yet, given the relevance of the theoretical argument involved, as applied to the phenomenon of geomagnetism and stellar creation,

rather than nuclear power so as to guide it into a different examining sector of the Patent Office.

In spite of all this I am currently seeking the grant of a patent in the U.K. which is more open in declaring its technical foundation in spite of its objective aimed at tapping energy from the aether and, as the specification has now been published prior to it being subjected to what in the U.K. we call "substantive examination," I present below the relevant sections of its text. I refer to Patent Application GB 2390941 A as published on January 21, 2004, its initial filing date being March 9, 2002, some three months before I was due to speak on the subject at an Energy Symposium held in Berlin in June of that year.

As to the details of the invention claimed, they can be inspected on the public record via http://gb.espacenet.com upon entry of the Patent number GB2390941, my purpose here being to present the case by which I hope to justify the prospects for tapping energy from the aether as a matter of physics. Essentially, the apparatus involved is a combination of two capacitors having concentric cylindrical electrodes such as one finds in Leyden jars. The two inner electrodes are connected together and to a high voltage d.c. source, whereas the two outer electrodes are connected through a primary winding of a high frequency transformer, the winding being earthed at its center and the secondary winding of the transformer delivering power output. The aim of the circuit design is to set up oscillations of electric charge as between the two capacitors so as to exploit the effect of the aether in enhancing capacitance upon capacitor discharge in comparison with the regular capacitance that applies during the charging stage, whereby excess energy tapped from the aether is delivered as output. The underlying physical principle involved is the same as that exploited, unknowingly one assumes, by the above-mentioned Lee Bowman but, knowingly of course, by Mother Nature in creating the Sun and other stars. You must judge for yourself how likely this is, but after reading the remainder of this section which is now quoted verbatim from the Patent Specification:

> Given that energy can be stored in that "hypothetical" substance that sits between the plates of a charged capacitor, and recovered for use when needed, the aether must exist, though ill-founded arbitrary hypotheses as to its form and properties can, of course, be challenged. Our quest on the "free energy" front is to learn about it by fathoming the truths evident from experiment and discovery which have bearing on its real existence.

This invention relates to a new and non-conventional means for the generation of electrical power. The energy source is the quantum underworld of space, the aether medium of the vacuum state, long recognized for its ability to allow the storage of electric field energy by reacting as its intrinsic charge is displaced, a process understood by physicists by reference to the research findings of Clerk Maxwell.

The current state of the art of electrical power generation does not recognize the possibility of ultimately tapping energy from the aether. Physics is taught on the basis that energy cannot be created or destroyed, inasmuch as it is conserved in all physical processes, though it can be degraded in its usefulness, as by burning of hydrocarbons and conversion into heat which dissipates as by radiation into outer space. The aether as a source or as an absorber of energy is not deemed to serve any specific role in the physics of energy deployment, it having been dismissed from consideration by invoking the notion of "field energy" without admitting the specific physical reality of something in space that accounts for the properties involved.

Theoretical physicists have, however, come to suspect that space devoid of matter is nevertheless a seething sea of activity subject to sporadic energy fluctuations which can create electron-positron pairs that exist momentarily before decaying back into their quantum underworld. Yet those same physicists deny all possibility that this energy resource of space itself can be exploited to provide useful power on a scale large enough to rival the role played by atomic power plants and fossil fuel generating installations.

Curiously, they do subscribe to the belief that one day they may be able to generate power on a viable commercial scale from fusion reactors by processes replicating what they believe sustains the Sun's heat output as hydrogen is transmuted into different atomic forms. In contrast with this rather elusive objective, it having proved beyond reach even after half a century of effort, this invention is based on success in generating power by replicating, not the Sun's onward energy decay, but rather a process akin to that by which the Sun itself was created from energy drawn from the enveloping aether medium.

The invention to be described below has emerged from an in-depth theoretical investigation into the properties of the aether and quite independently of any of the well known claims of published record which feature at the fringe of mainstream scientific literature. A recent and very well presented account of what amounts to a century of relevant energy history is the book *The Search for Free Energy* by Keith Tutt, published in 2001 by Simon & Schuster [now available from *Infinite Energy* under the new title *The Scientist, the Madman, the Thief, and Their Lightbulb*]. Here in this book is a comprehensive background of information concerning the energy devices of several researchers but the references to Nikola Tesla and T. Henry Moray are particularly pertinent to the subject of this invention and, though imposing a limitation on what can be legitimately claimed by this patent application, they serve also as a basis for a very important lesson to those engaging in this field of invention.

The lesson is that it is not sufficient to build and demonstrate something that works, if you do not fully understand why what you have devised actually does work. This is espe-

assembly, a set of eight Alnico magnets mounted on a central rotor disc coupled by a non-slip pulley drive to two smaller rotor discs, each carrying four Alnico magnets, rotating at twice the speed in the opposite direction. The axes of the cylindrical magnets were parallel to the rotor axes and the arrangement was such that, at diametrically opposite positions near the rim of the central rotor disc, pairs of magnets would have a passing face-to-face encounter eight times per revolution. This means that the powerful magnetic flux of the overlapping magnets would experience a substantial pulsation and, Alnico being a metal alloy that has the high conductivity property of metal, the spin of the magnets at their rotor frequency means that a radial EMF is induced in each magnet, thereby, owing to conduction, displacing a substantial measure of electric charge from the core of the magnet to its cylindrical surface. Then, because that flux pulsation implies pulsating charge deployment, this can be seen as a recipe for importing energy steadily from the aether, as I will explain below after quoting a few words from that account in *Space Energy Journal*:

> The machine continued to rotate for 15 minutes before Bowman terminated the operation and inspection by Mr. Lienau, who was much impressed and unable to account for the phenomenon. It is understood that Bowman had applied to patent the device, but was refused because the Patent Office considered it "an unpatentable perpetual motion machine". . .At the time of the demonstration Bowman was 75 years old. He decided, according to one report to have his device taken apart and after his death to have the parts buried in different locations in California.

This was a sad ending, bearing in mind that the Patent Office exists to aid the advance of technology for the benefit of mankind.

An Observation

On the question of energy being fed to us from the aether, one must wonder why scientists have missed something that is so obvious once it is pointed out. Again it is thanks to our discovering that the hydrogen atom has a heavy positively charged nucleus, around which a negatively charged electron has motion sustained by a quantum interplay with something hidden in space, that we have insight into one of the great mysteries of Nature—the Sun's energy source.

Just because we discovered that the fusion of hydrogen atoms triggered, one assumes, by temperatures in excess of 100,000,000 degrees, can release vast amounts of energy in forming heavier atoms, that does not mean that the Sun is a nuclear furnace. Surely, we should learn something from the teachings of quantum theory dating back some 97 years when Neils Bohr led us to accept that those electrons in hydrogen move in orbit at a radius of 5.29×10^{-9} cm about the proton nucleus. From this we know for sure that when gravity compacts hydrogen atoms tightly together to reach a mass density of 1.41 gm/cc, based on one atom per cube of side distance equal to the diameter of those orbits, then electrons of adjacent atoms will collide and there will be ionization and so energy radiation. That happens to be the average mass density of the Sun, a telling point! What it really tells us is that, because two free protons are pulled together by gravity at an acceleration rate that is 1,836 (the proton/electron mass ratio) times the corresponding action between two electrons then so there will be more protons than electrons inside the body of the Sun, enough to set up a positive core charge and assure equilibrium and uniformity by balance of gravitation attraction and electrostatic repulsion within the body of the Sun.

So you see, we look at a Sun that radiates energy owing to those electrons colliding and sustaining its capacity to radiate thanks to the quantum underworld of space, the aether, replenishing the energy to get those electrons back into their Bohr quantized state of motion once they are recaptured by a free proton to reform the hydrogen atom. Really, before we pretend that the Sun owes its energy source to it being a "fusion reactor," somehow controlled and not being an unstable hydrogen bomb, we should explain why it does not conform, as explained above in the introduction, with the same physics that governs the atoms that make up our body form.

Also, and bearing in mind that the Sun exhibits a magnetic moment as if it were itself a magnet, and further, owing to its ionization, is an electrically conductive medium, do we not see something in common as between the Bowman perpetual motion machine and the Sun itself, namely the mystery of their sustained source of energy?

Another Invention

This brings me to the main message of this contribution. Being professionally skilled in securing the grant of patents in the electro-technological field, I well know how to navigate a patent application to avoid confrontation such as posed by the "perpetual motion machine objection." One merely describes what one builds or aims to build and avoids assertion as to how it performs. Even with the Bowman machine, set running by an initial manually applied torque, if given enough push to overcome the cogging action of the magnets, plus some, it can be expected to run under its own inertia for a few moments. It could be argued that it demonstrates something useful, if only as an education tool in the realm of magnetism, and, being a machine and something one can manufacture, it is, if new and not obvious, proper subject matter for a patent. Once the patent is granted it surely could not then be invalidated on the basis that what it covers really is a machine that surprises us by running without power input. At least it would be a fascinating law case for an infringer who sells a workable perpetual motion machine to then challenge the validity of the patent on the basis that it should never have been granted because the law says perpetual motion is impossible.

Meanwhile, however, one must avoid the words "perpetual motion" in making patent applications, but I have to admit failure in dealing with the U.S. Patent Office in a patent application of my own, one concerned with "cold fusion." I can but say that I erred in not realizing that the Patent Examiner involved would, in a sense, adopt his own version of the relevant law in regarding "cold fusion" as synonymous with "perpetual motion" and so "unpatentable." I should not have used the expression "cold fusion" at a time when so much publicity and vested interest was involved in that realm of invention or, as I later found in securing grant of U.S. Patent No. 5,734,122, I should have avoided the problem by writing the specification as if it were directed at applying technology concerned with thermoelectric power,

The Physics of Perpetual Motion

Harold Aspden*

A Letter from the Author

Dear Eugene:

I very much appreciated being sent the DVD "From Plasma Power to the Aether Motor." It arrived just after I received from the U.K. Patent Office the now published patent specification covering an invention I spoke about at the Binnotec Energy Symposium in Berlin in June 2002, at which Paulo and Alexandra Correa reported their progress on the pulsed plasma power theme.

As I played the DVD, I had mixed feelings. Here was clear evidence that physicists should wake up and rethink their ideas about the way forward on the energy front, but yet the scope for really significant levels of power generation are seemingly limited.

My thoughts since I wrote my article, "Gravity and Its Thermal Anomaly" (*IE* #41), have been to consider the prospect of high voltage capacitor technology, which I outlined at the June 2002 meeting and at which Paulo and Alexandra Correa gave their presentation.

I immediately set in to writing this article, "The Physics of Perpetual Motion," after watching the DVD, as this is an appropriate time to provide some input for *Infinite Energy*.

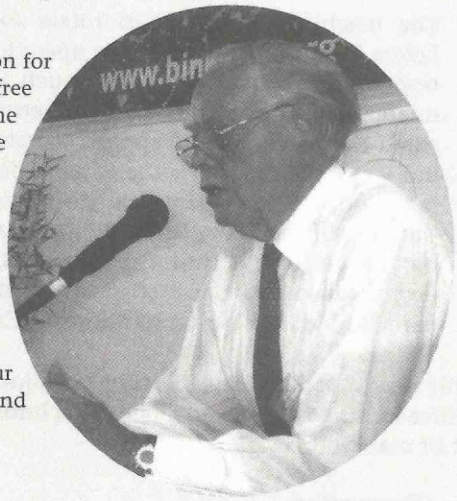
Being now 76 years of age, I suppose I am more interested in gaining a little recognition for the physics theme I have pursued now for some fifty years, even though I know the free energy theme is far more important. Success on the latter, regardless of who triggers the eventual breakthrough, is sure to be the only way that my theory can, as it were, prove itself. That may explain why I regard my U.K. Patent Application GB 2390941A more as a publication than protecting an invention for commercial reasons.

This may explain why my main effort in 2003 was in writing "The Physics of Creation," which I have placed on my website (www.aspden.org). I will shortly be re-editing it in one further iteration before regarding it as completed. It did, however, conclude by introducing the topic of the patent just mentioned.

I will now in 2004 get back to the new energy theme. I wish you well and think your efforts in sustaining *Infinite Energy* at such a high quality level are indeed impressive and warrant the highest commendation.

Yours sincerely,

Harold Aspden



Harold Aspden at the Binnotec Energy Symposium, June 2002.

Introduction

Although scientists in general regard the notion of perpetual motion as being too absurd to contemplate, if we exercise a little common sense based on what those same scientists teach, then perpetual motion is a reality. Once the science student learns that atoms consist of an electrically charged nucleus about which electrons are kept in sustained motion thanks to their interplay with the quantum underworld, that which determines their orbital distance from the nucleus and the angular momentum of their motion, he or she has been introduced to perpetual motion. Every atom whether in us or in surrounding matter embodies the proof that perpetual motion is a reality and stands as evidence showing that if those electrons shed energy as by radiation then somehow that enveloping quantum underworld that we used to call the aether has a way of feeding in energy as needed to sustain that motion. The aether is therefore an energy source and the challenge we face is how to tap into that source before we become wholly dependent upon rain and wind, the sources that provide hydroelectric power and power from windmills.

An Invention

An historical feature of patent law denies the grant of patents for what are seen by the Patent Examiner to be perpetual motion machines. Wheels that turn for no apparent reason are outlawed. Thus I was not surprised upon reading a short account of the Bowman Permanent Magnet Motor that appeared at pp. 22-23 of the December 2003 issue of *Space Energy Journal*. It explains how, in 1954, an Electrical Engineer named Carl C. Lienau on a visit to California witnessed Lee Bowman's motor in operation and was duly impressed. No electric power was supplied to drive the

should offer a New Energy Demonstration Car Grand Prix, a prize for the first self-powered New Energy toy car that travels ΔX-meters further than a conventional hydrogen-fueled/solar car like this one will go—round and round in broad daylight on a flat surface? Think about it. . .Is anyone up for offering such a prize?

Fuel Cell Mania as a Diversion from Real New Energy: The End of the "Hydrogen Economy"

Yes, fuel cells, elegant as their makers may build them—and we really appreciate the tough engineering and science that has gone into them—are no substitute for New Energy. They are a diversion, but their proponents have not seen the light. But soon the functional equivalent of the Wright flyer will be in the skies, and the era of "trains" will be circumscribed. For now, these cells hold a great attraction for their devotees. Yes, they do work *today* in powerful systems, we'll grant that, which is more than can be said about New Energy. But recall that transistors didn't run radios either when they crawled out of Bell Laboratories in 1947. Small important effects, if prized highly enough, eventually are made into robust technologies.

Let us conclude this assessment of fuel cells and the hydrogen economy with some of Jeremy Rifkin's historic, already obsolete words. His paean to conventional hydrogen: "Hydrogen is the lightest and most ubiquitous element found in the universe. When harnessed as a form of energy, it becomes 'the forever fuel.' It never runs out, and because it contains not a single carbon atom, it emits no carbon dioxide. Hydrogen is found everywhere on Earth, in water, in fossil fuels, and all living things. Yet it rarely exists free-floating in nature [Ed. Note: he means, on Earth]. Instead, it has to be extracted from natural sources." Note the use of the word "extracted." (p. 8) *Not once* in his entire duplicitous tome on hydrogen is there a formal, *explicit* statement that it takes much more energy to split hydrogen from a water molecule than one gets back when one consumes hydrogen in fuels cells or combusts it in an engine.

Taking his cues from the financial furor over the worldwide web, he writes: "The worldwide energy web (HEW) will be the next great technological, commercial, and social revolution in history." There never will be any such web. He says, "Since hydrogen is found everywhere and is inexhaustible if properly harnessed, every human being on Earth could be 'empowered,' making hydrogen energy the first truly democratic energy regime in history. . .Effectively harnessing it as a source of power would provide humanity with a virtually unlimited source of energy—the kind of energy elixir that has long eluded alchemists and chemists alike." Blah, blah, blah. . .Well, as it turns out, the LENR modern alchemists have done the ancient alchemists one better.

It is a nice idea, quite romantic, while it lasts, this concept of a conventional hydrogen economy. I fully expect that this hydrogen economy will be passed over by the arrival of real New Energy, long before thousands of hydrogen fueling stations are built, and too many more $billions are wasted on research. But the most rabid proponents, steeped in rigid ideas about the limits on energy defined by the present "laws of physics," will babble on for some time until they receive their wake-up call and their much-deserved oblivion.

Here is how Jeremy Rifkin thinks about the constraints on energy facing civilization, "The fact is, there are ironclad rules that govern the flow of energy, and if those rules are breached, civilizations can perish. The laws of thermodynamics tell us what, in the final analysis, the upper limits are in the pursuit of human power over the environment. Societies that reach beyond the constraints imposed by their own energy regimes risk breakdown." Oh, he knows so much about the limits of physics—impressive. He knows from nothing! More, "The days of cheap energy are passing—and with that passage it is unrealistic to expect the kind of economic growth that was experienced during the 20th century." How sad, such an errant economic seer. And, "In the future, we may have to make uneasy tradeoffs between personal mobility and eating." I recall that Sir Arthur C. Clarke said that we should learn to "eat oil, not burn it," but that was a New Energy message, not about fuel cells. And more from Rifkin, "When future generations look back at this period, tens of thousands of years from now, the only historical legacy we will have left them in the geological record is a qualitative change in Earth's climate." Ending this sad refrain, "There is no foreseeable scenario on the horizon in which oil—or for that matter, natural gas, coal, heavy oil, tar sand, or nuclear power—can reverse the trend and provide enough energy per capita to bring the growing world population back up to the peak reached in 1979." "Never, never, never, never. . ." is all he knows. He is in good company with the academic physicists.

Yet ever so dimly, this "hydrogen economy" man perceives a truth, which one hopes will be brought home to him in his lifetime: "When every human being on Earth can be producer of his or her own energy, the very nature of commercial life changes." He's right about that, but that cannot happen in the way he and his fuel cell comrades imagine. The future holds many unsettling surprises for them, but for now they are riding high—right into the setting sun.

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7. Hayden, H. *The Energy Advocate: A Monthly Newsletter Promoting Energy and Technology*, Vol. 7, No. 7, P.O. Box 7595, Pueblo West, CO 81007.
8. Ball, J. 2003. "Industries Seek Fuel-Cell Funding," *The Wall Street Journal*, November 18, A17.

enough hydrogen to make a practical hydrogen fuel tank for a car.

**Lack of environmental benefit:* More than 95% of U.S. hydrogen is currently produced from natural gas, and vehicles running on fossil-fuel derived hydrogen will not reduce greenhouse gases compared to hybrids—like the Toyota Prius—running on gasoline. Thus, until the U.S. becomes far more heavily invested in renewable energies such as wind or solar power, there will be no environmental incentive for the consumer to purchase hydrogen fuel cell vehicles.

**Distribution:* There is no fueling infrastructure built around current hydrogen technologies, and creating one would be costly: $600 billion to cover 40% of the cars on the road, according to Argonne National Laboratory.

**Safety:* Hydrogen is a very leaky gas that is highly flammable and burns invisibly. Very onerous codes and standards are required for handling and distribution.

**Cost:* Currently, hydrogen as a fuel is prohibitively expensive—equal to gasoline at $4 to $6 per gallon for hydrogen from pollution-emitting fossil fuels and equal to gasoline at $6 to $10 for hydrogen from pollution-free renewable sources.

Romm says that hydrogen hype is bad for the climate change energy policies that he favors, because it could divert financial resources from better policy directions. He fears a backlash from consumers, if hydrogen cars are introduced prematurely. He opposes diverting our limited natural gas reserves to make hydrogen for hydrogen cars—such natural gas is better used, he says, in cleaner power plants. He writes, "A megawatt-hour of electricity from combined cycle natural gas plants releases about 800 pounds of carbon dioxide, whereas a megawatt-hour from even new coal plants can release more than 2200 pounds."

Romm's final recommendations, which do not, of course, include New Energy (since his alma mater's snow job against cold fusion, in favor of its pet white elephant, hot fusion, has been so effective): "Take a long-term, conservative perspective on hydrogen; Sharply increase research and development into other clean energy technologies; Launch a major national effort to use electricity and natural gas more efficiently; Start reducing carbon dioxide emissions now by using low-cost strategies; Begin a national effort to encourage combined heat and power; Phase-in carbon dioxide related standards for cars and light trucks; Prepare the public for tough choices ahead." Well, there's some hope for him in his reference to those "other clean technologies"; he might stumble across LENR or the other shockers at www.infinite-energy.com. Maybe we'll even see him at ICCF11 in Marseilles in October/November. Someone should buy him a ticket!

A Fuel Cell Car Experiment Kit—Drive It Yourself!

In thinking about this abbreviated coverage of the very intricate yet oh-so-simple fuel cell matter, it dawned on us that *Infinite Energy* readers would like to know about a fuel cell-powered car that they can already purchase for only about $160.00, and which they could build in their leisure time. We have even pictured the sparkling gadget on the cover of this issue. This Thames & Kosmos Fuel Cell Car and Experiment Kit features a plastic-bodied table-top vehicle that one can build, and perform various instructive experiments.

Of course, the car has to come equipped with a small solar cell PV panel that is used to make electricity to split water in its "fuel tank"—so that the hydrogen from the electrolysis can be used in the supplied fuel cell. Thus, the kit provides a tangible insight into this obvious shortcoming of fuel cells—the need for some *other* energy source. But it was very ingenious of the kit-makers in Germany to think of this educational device at all and to illustrate its wonderful, highly user-friendly instruction manual. The hype on the kit manual is endearing: "Build your own model Fuel Cell car that runs on water! Learn how emission-free vehicles, power stations, machines and power tools could soon be used around the world. Through a series of simple experiments, you will learn how Fuel Cells work and how they might power the future!"

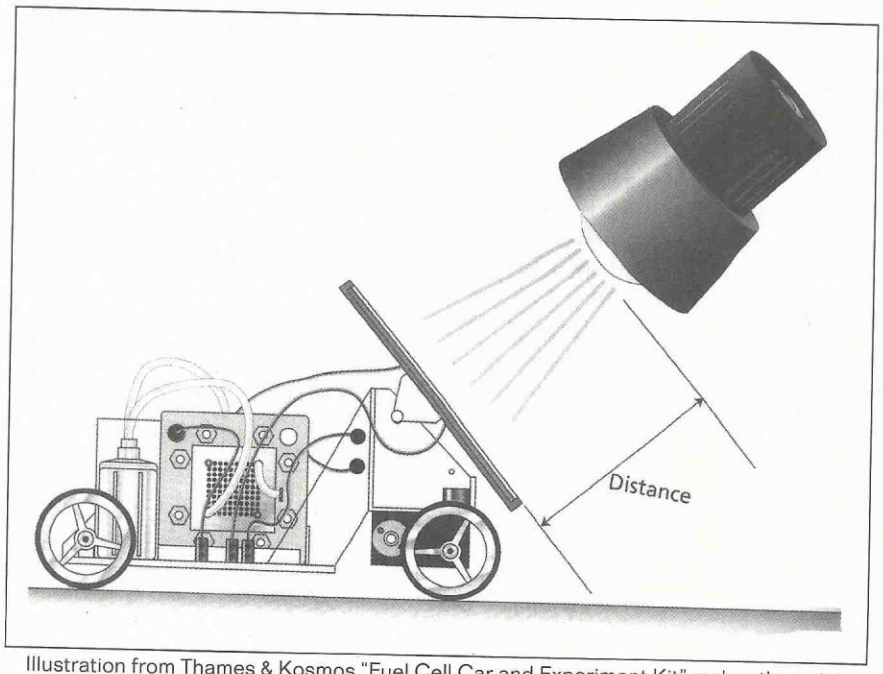


Illustration from Thames & Kosmos "Fuel Cell Car and Experiment Kit" makes the point that fuel cells are dependent on *another* energy source—in this case an electric light.

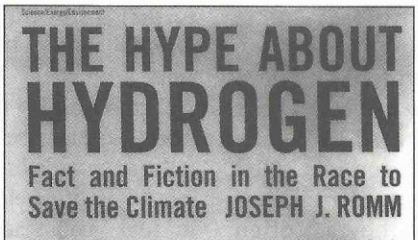
If this editor can ever get out from under the harsh taskmaster of editorial deadlines, he might have some time to play with this wondrous toy. Either that or his now very young grandchildren may inherit it as an antique! By then, one hopes, New Energy will have made the concepts illustrated in the kit a quaint laughing stock.

Even better, one hopes that people in the New Energy field will have been motivated by this article to come up with small demonstration devices that will power small toy cars like this—which will go hundreds of meters further than any conventional fuel cell toy car, even further than one equipped with solar cells on a bright sunny day could ever travel. Perhaps we

employ mini-fuel cells using hydrogen or methanol fuel in portable computers or digital cell phones. There may be niche markets for other old energy too, *e.g.* the fragrant old ceremonial wood fire in one's mountain cabin wood stove, or the natural gas flame in a simulated wood fire in a suburban fireplace.

However, it seems to me that with the advent of truly New Energy, such as the much-discussed paradigm of the small LENR home power source, or the vacuum energy electric generator in one's basement, mere conventional chemical energy—such as are *all* fuel cells—has no chance at all to become a dominant energy carrier/source. Ergo, fuel cells are, indeed, fundamentally a technological dead-end. That fuel cell people have not recognized this is attributable only to their ignorance—willful or otherwise—of what is going on in New Energy. The only "comfort" that fuel cell people can take today is that New Energy has not—not yet—put them out of business. We don't deny, of course, that continued willful neglect of New Energy by the greenies and abuse by Establishment academics—and infighting even within New Energy!—can continue to delay the *real* energy revolution.

It is noteworthy that of several books dealing with hydrogen that I recently examined, including and beyond the Rifkin book,[3,5,6] *none* of them made any mention whatsoever of cold fusion or any other provocative new energy source—not that I expected them to do so. Furthermore, few of these mentioned, even in passing, the infamous *hot* fusion; that *did* surprise me.



Fuel Cell Infrastructure and Hype

If one is planning for a "hydrogen economy," the first issue that must be addressed is what *other* energy sources will be used to generate hydrogen from water electrolysis or steam reformation of natural gas. Here is where the hydrogen-hypers are most devious with their facts and figures. But retired University of Connecticut Professor Howard Hayden, who writes the monthly newsletter *The Energy Advocate*, has not been coy. In a recent issue[7] (February 2003), he writes of water electrolysis: "If all processes involved occurred at 100% efficiency, it would require about 140 megajoules (140 MJ) of energy input to produce a single kilogram of hydrogen. In the real world, electricity—from some source—can be used to produce hydrogen by electrolysis. If the efficiency were 100% (and it isn't), the efficiency of electrical production certainly is not. That efficiency varies from about 85% (hydropower) to about 5% to 10% for photovoltaic (PV) cells, with conventional electrical energy from fossils [power plants] and nukes coming in at around 30% to 40%. Optimistically, we'll use 40%; this means that we have to put in 350 MJ to produce a kilogram of hydrogen." He points out that hydrogen combustion would recover only 100 MJ of heat, while some 20 MJ would be lost as water vapor. The overall efficiency from fuel to heat is then only 34%.

But for fuel cells the math is different. Hayden says that a 60% efficient fuel cell will use 84 MJ of that original 140 MJ, so our original 350 MJ cost gives us only 84MJ of electric power, for a net efficiency of just 24%. Since electric motors, as used in electric vehicles can be 80 to 90% efficient, other losses bring the overall transportation energy efficiency from original fuel energy to motive power down to 20% to 22%. And remember, these figures used robust efficiency—40%—at the origination of the energy production. The picture is so much bleaker for hydrogen when PV's are the starting point.

Then there is the problem of the vast distribution and storage of hydrogen. Much technological development in support of fuel cells (and for the less efficient internal combustion hydrogen engine) has gone into figuring out how to store hydrogen at high density and safely, both for home and automotive use. But that is just one needed step in the hydrogen infrastructure. Thousands of hydrogen fueling stations will be required, costing many billions of dollars. An article in *The Wall Street Journal*[8] says that General Motors and Shell have estimates ranging from $10 billion to $19 billion just to begin the fueling station infrastructure for hydrogen vehicles. GM proposes 11,700 new hydrogen fueling stations ("so a driver would always be within two miles of a station in a major urban area," with highway station separations of some 25 miles). Shell, by contrast, proposes converting some 44,000 existing stations in the U.S. *WSJ* journalist Jeffrey Ball writes, "Byron McCormick, GM's executive director of fuel cell activities, likened investment in building a hydrogen infrastructure in the 21st century, to investment in the railroads in the 19th century or in the interstate highway system in the 20th century." He's right about that! Think about how much easier it will be when *real* new energy makes its debut. There will be no significant fueling infrastructure to deal with.

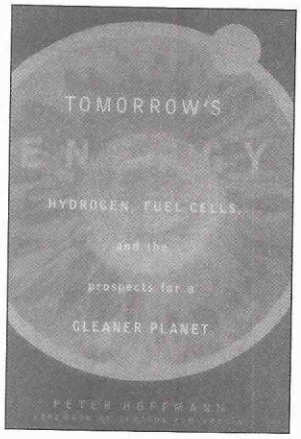
It is a great irony that the most devastating critique of the "hydrogen economy" comes from one Dr. Joseph J. Romm (an MIT-trained physicist), who oversaw hydrogen and transportation fuel cell research in the Department of Energy during the Clinton administration. His recent book, *The Hype About Hydrogen: Fact and Fiction in the Race to Save the Climate*[6] tells all. His overall message is that "commercially viable and environmentally beneficial hydrogen vehicles are in the post-2035 future." His perspective is driven by his assessment (which many would question) that "climate problems [global warming] could become irreversible." He was quoted in *The New York Times* (February 6, 2004, p. A19), "People who want to build 'hydrogen highways' and drive a hydrogen car in 10 or 15 years on a mass scale, are just kidding themselves." Also, "Fuel cell cars will not be environmentally desirable for decades, because there are better uses for the fuels you can make the hydrogen out of."

From the summary "Fact Sheet" which accompanied Romm's book:

> **What are the current barriers to emission-free hydrogen fuel cell-powered vehicles?**
>
> **Technology:* Currently, fuel cells are 100 times more expensive than gasoline engines and there is no substance known to humankind that can store

So it goes with the media frenzy. But watch out, investors, for the fuel cell hype could become another dot-com fiasco! *The Economist* back in 1997 (October 25-31 edition) featured this hype on the cover: "How Hydrogen Power Can Change the World." It spoke of "the third age of fuel": "For 100 years the source of that power [for the industrial revolution] was coal. For almost another 100 it has been oil. But, as the revolution that [Matthew] Boulton helped to start enters its third century, it may be about to embrace a third fuel: hydrogen." *The Economist* gets it all wrong in its second paragraph, calling the fuel of the "hydrogen economy" "the main source of energy." Bah! Such carelessness. Hydrogen is not a *source* of energy in the classical physics, conventional use of hydrogen in fuel cells or combustion; *it is an energy carrier*. Sure, if you strip the hydrogen off hydrocarbons, as is done for some kinds of proposed fuel cell systems, then you are using hydrogen as a primary fuel—but you are really using hydrocarbon fuel (*e.g.* gasoline) again, and where has that gotten us? But if you are stripping H_2 out of water, then you are conventionally having to use another entirely different source of energy to get that hydrogen—and this will require much more energy than one gets back when the hydrogen is processed in the fuel cell. Ergo, hydrogen *per se* is *not* a fuel. (Editor's Note: My apologies to *IE* subscriber, heretical geologist Warren Hunt, who is convinced that deep within the Earth there are significant reserves of free hydrogen that we might ultimately learn to tap.)

So, what, if anything, is wrong with hydrogen fuel cells? First of all, as we have seen, they *do not* represent a new source of energy, but that is precisely how they are often billed in some publications that hype them. Jeremy Rifkin blurts out at one point in his book, crossing the line from insidious deception to outright falsehood: "For the first time in human history, we have within our grasp a ubiquitous form of energy, what proponents call the 'forever fuel.'"(p. 217) Hydrogen is not a "ubiquitous form of energy"—it is merely a carrier of energy, once it is obtained at the cost of other energy input from some other source. Today, for example, the least expensive way to make hydrogen is by steam reformation of natural gas (methane). Electrolysis produces a more purified form of hydrogen, but this requires a source of electric power—solar, nuclear, chemical, etc.

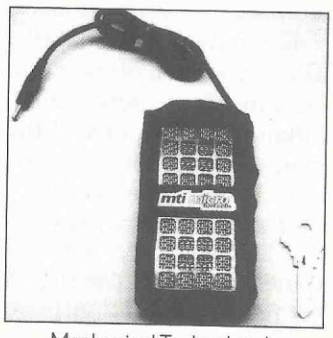


The person who coined the term "forever fuel," back in the 1980s is, by contrast, a man of great integrity and carefully assembled knowledge about fuel cells, Peter Hoffman, Editor of the monthly publication, *The Hydrogen Fuel Cell Letter* (www.hfcletter.com). His book, from which Rifkin drew inspiration, was *The Forever Fuel: The Story of Hydrogen* (Westview Press, 1981). This work has been updated by Hoffman in *Tomorrow's Energy: Hydrogen, Fuel Cells, and the Prospects for a Cleaner Planet*. He states explicitly, as all discussions of *conventional chemical hydrogen* should: "Hydrogen is not an energy 'source,' a mistake still made fairly often by otherwise sophisticated, well-informed people. That is, it is not primary energy (like natural gas or crude oil), existing freely in nature. It is an energy *carrier*—a secondary form of energy that has to be manufactured (like electricity, which doesn't exist freely in usable form either)."

There is nothing inherently "bad" about fuel cells, in fact they are quite elegant solutions to generating electricity in particular applications. Though the invention of the fuel cell hearkens back to the mid-nineteenth century, they were pretty much a curiosity until NASA found a use for them in manned spacecraft, for generating electricity, and regenerating water from the original hydrogen and oxygen stocks (stored in liquid form, cryogenically) that are brought along at great expense in the chemically propelled spacecraft. Some rocket systems today, like the space shuttle main engines, ironically also use hydrogen and oxygen in combination as a high specific-impulse propellant.

Hydrogen and Hydrogen Fuel Cells in the Context of *New* Energy

Without venturing much further into the territory of exactly where hydrogen fuel cells and other kinds of fuel cells stand today in the marketplace—costs are said to be falling towards or below $1,000 per kilowatt of electrical power in fuel cell stacks—let us be completely clear about a devastating and fundamentally unavoidable logical equation:



Mechanical Technology's methanol micro-fuel cell prototype.

***IF (1):** There comes into existence a truly new energy source, in the sense that it works on radically unsuspected physics principles (such as, for example, LENR), and if that new energy source is able to provide energy from effectively *free* sources, for example, from water, or from the vacuum of space, or from the ambient thermal heat (without recourse to a lower-temperature exhaust reservoir—*i.e.* an extension or violation of the Second Law), and **IF (2):** the *new* source of energy has *at least as much as but perhaps more than the power density of ordinary chemical energy*, then it follows that any energy source that depends on an energy fuel that is *not free* will suffer greatly, probably catastrophically in comparison. This will be true precisely because the conventional fuel cannot be obtained for *free*—whether this be oil, coal, natural gas, hydrogen, or fission nuclear power. (We'll be generous and admit that hot fusion's fuel is free—but hot fusion technology will be very, very expensive, if it is ever built at all.)

Furthermore, if the safety, environmental, and power density characteristics of the *new* energy source are such as to be acceptable for consumer use, and have the properties as well of being decentralized energy, *i.e.* not electric grid-dependent, or pipeline-dependent, time-of-day-dependent or weather-dependent, then it will be difficult or impossible for the non-new energy source to be competitive for virtually all purposes. This is not to say, as an example, that even in a raging New Energy Age, people might not

of the "hydrogen economy." His aphorism is quoted approvingly by *The Economist's* latest wunderkind on the energy beat, V.V. Viatheeswaran[3]: "Negawatts are often cheaper than megawatts." In one section of his book, Viatheeswaran writes, "For some years now the Sage of Snowmass [Lovins] has been making another sweeping forecast for the future of energy, and again he is sounding fanciful, 'This breakthrough will be like the leap from the steam engine to the diesel locomotive, from the typewriter to the laptop computer. . .it's a really disruptive technology.' . . .With a flourish befitting a mad scientist he reveals his creation: The Hypercar." This is a no doubt well-engineered conception, in its own frame of reference, which is powered by conventional hydrogen chemistry in—you guessed it—hydrogen fuel cells. Fuel cells are the "Next Big Thing," puffs Viatheeswaran.

But just what is a fuel cell, which is said to be the corner-stone of the hydrogen economy? First, realize that fuel cells come in several different types, only a few of which have been touted for use in the proposed conventional "hydrogen economy." In purest form, one can think of a fuel cell as a reverse electrolysis cell. So instead of, for example, water being decomposed into hydrogen and oxygen (separately at two different electrodes) by the passage of electricity between the electrodes, in a fuel cell hydrogen may flow through and from an anode catalyst material (such as platinum), then through an intervening material substrate that allows the ionized hydrogen to move toward the cathode, where it is recombined with oxygen, producing water. The electron removed from the hydrogen at the anode then flows through the external power load of the fuel cell back to the cathode side, where it participates in the formation of the water by-product.

John Grove, discoverer of the basic fuel cell principle.

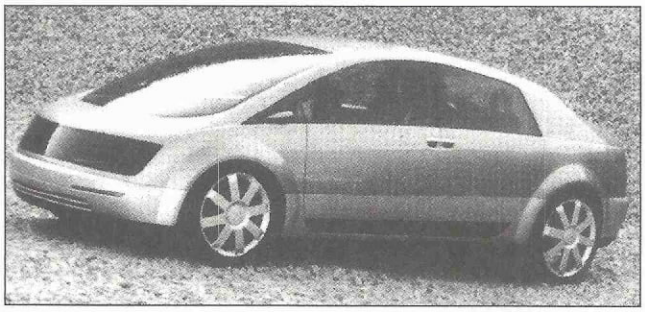
The basic fuel cell principle was actually discovered in 1839 in England by a research physicist friend of Michael Faraday, John Grove. But though the principle of the fuel cell has been known for a long time, there was apparently not a great technological need for electricity-producing fuel cells (called "gas batteries" originally) for over a century after their discovery. Chemical storage batteries or primary cells worked just fine for most applications.

But in recent years, in fact, "fuel-cell mania" seems to have captured the imagination of investors and the media, in what appears to be a head-long rush toward irrationality, cheered on by the likes of the Jeremy Rifkins of this world, who, in particular, don't want civilization to have command of larger energy resources. President Bill Clinton in 1997 bubbled, "Ballard Power and United Technologies are leading powers in developing fuel cells that are so clean. . .their own exhaust is distilled water." True enough, but usually not mentioned in the same breath of clean water vapor—even by U.S. Presidents (George W. Bush has most recently succumbed to this fuel cell malady)—is that some *other* energy source has to generate that hydrogen, and it might be a polluting source, admittedly not where the fuel cell was being operated, which is at least some advantage.

This is not, of course, to blame the technologists of enterprising fuel cell companies for the excesses of the Rifkin-clique of modern-day Luddites. But it is true that fuel cell people can certainly be accused of amazing blindness for not at least casting wary or interested glances toward what is going on in the LENR field. After all, LENR research began, of course, with the work of some of the world's foremost electrochemists—Martin Fleischmann, Stanley Pons, John Applebee, and John O'M. Bockris. How could these fuel cell people *not* notice what is going on in LENR?! It is all the more ironic, because leading cold fusion pioneer Bockris was first to coin the very term "hydrogen economy" back in the 1970s. "Boiled down to its minimalist description, the 'Hydrogen Economy' means that hydrogen would be used to transport energy from renewables (at solar or nuclear sources) over large distances; and to store it (for supply to cities) in large amounts."[4]

It shows, perhaps, how thoroughly mind-deadening has been the DOE-launched assault on the LENR phenomenon. Now with the publicized DOE review of the cold fusion question pending in early 2004, perhaps the fuel cell community will at least reconsider what it is doing. One hopes it will. LENR could use its support. Recall that LENR (and associated energy-from-water claims, such as the BlackLight Power Corporation catalyzed shrunken hydrogen or "hydrino" process) posit energy reserves associated with hydrogen that range from hundreds to millions of times the energy release per unit mass of hydrogen in *conventional* chemical energy release. These phenomena utterly dwarf the piddling energy reserves of conventional hydrogen used in fuel cells. In fuel cells the fuel is not free, but in *new physics energy* hydrogen, the fuel *is* free, because only a tiny fraction of the energy produced need be tapped to self-produce fuel from water.

A two-page color advertising spread by General Motors in a recent *New York Times* (March 16, 2004, pp. C12-13) shows two little girls in a colorful plastic toy car tootling along a path through green grass with an expansive blue sky. The message written large in the heavens: "WHO'S DRIVING THE HYDROGEN ECONOMY?" More hype in the ad: "The hydrogen economy isn't a pipe dream. And it isn't the buzz du jour on the front page of the business section. The hydrogen economy is the endgame of a multi-faceted strategy GM set in motion years ago, with steps that are real, progressive, and well-underway. . .We're making sure children today are in cleaner cars tomorrow. And in the driver's seat of the hydrogen economy."


General Motors' five-passenger fuel cell-powered Hy-wire sedan.

Hydrogen Fuel Cells and the "Hydrogen Economy"

A Technological Dead End in the New Energy Age?

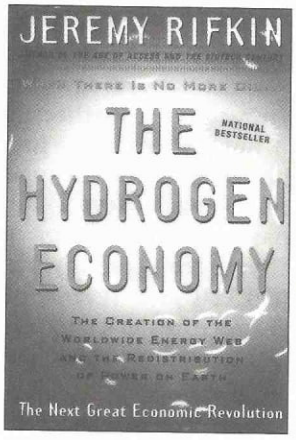
Eugene F. Mallove

A few weeks after "cold fusion" was announced in 1989 (the now verified excess energy and nuclear transformation phenomena is today more appropriately called LENR, low-energy nuclear reactions), several people who consider themselves to be environmentalists, who are presumably concerned with human welfare, made very negative remarks about the claimed discovery of Fleischmann and Pons[1]:

> "The fusion findings are the worst news that ever happened. Right when we are beginning to develop a global awareness of the problems of global society, here come some scientists saying we don't have to deal with those problems," extreme anti-technologist Jeremy Rifkin told the press. Amory Lovins of the environment/energy think-tank, The Rocky Mountain Institute of Snowmass, Colorado, had this to say: "Most of the costs of fusion will be the stuff you wrap around it to get electricity, from the turbine to the plant site, to the health physicists and other cleanup services you need, all of which will make it at least as expensive as fission. The right place for a fusion reactor is where we have one, 93 million miles away." He was glibly blasting cold fusion with *hot* fusion's well-known shortcomings, were thermonuclear fusion ever to be successfully developed. Biologist Barry Commoner of Queens College said, "Putting [a cold fusion device] in the basement or a car is nonsensical. . .As long as radiation is involved, you need major controls."

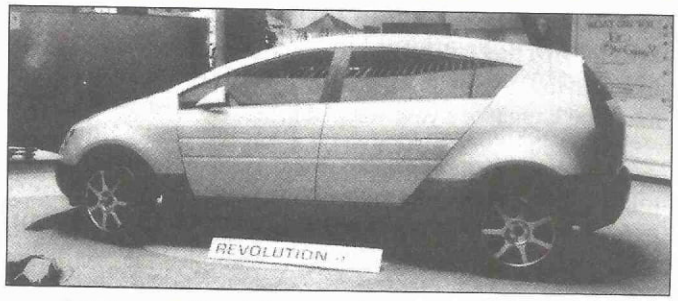
Mind you, these remarks were made in the early days of cold fusion, when it was not possible to know whether or not the claims of Fleischmann and Pons would be validated by independent testing—and, even if validated, what the likely course of technological development of cold fusion might be. It is crystal clear that these gentlemen were reacting in a knee-jerk fashion to something that was evidently threatening the entire intellectual frameworks on which they stood. By 2004, none of them had moved one millimeter in the direction of understanding or appreciating the New Energy revolution that is implicit in the validated new discoveries that came at and after the 1989 Utah announcement.

Jeremy Rifkin is a good example of a man with his head in the sand about New Energy. His "national bestseller" book, *The Hydrogen Economy: The Creation of the Worldwide Energy Web and the Redistribution of Power on Earth* (2002)[2] is mostly a political polemic, as one might expect given his outburst in the spring of 1989. Rifkin's "power" is not electrical power; it's political control. Strange to say, this is "power" of the very same type that has held back cold fusion/LENR—know-it-all government bureaucrats and academicians telling citizens what is right and what is wrong within science and rarely owning up to their mistakes. You'll find choice nuggets like this sprinkled throughout Rifkin's hydrogen opus, "The market economy, steeped in the exchange of goods and services, is found to be far too slow to accommodate the new speed of commercial life." Really?



The Rifkin hydrogen-hype thesis is that so-called renewable energy sources (specifically solar energy and windpower) will be used to generate hydrogen gas from the electrochemical splitting of water into hydrogen and oxygen. Then this hydrogen will be fed into a national—even international—grid of pipelines to power an energy-hungry world. At the user end in hydrogen fuel cells, the hydrogen is combined with atmospheric oxygen to produce electricity and some waste heat, with the main by-product of the reaction being water, which was the starting substrate. What's wrong with this picture? Lots, as we shall see.

Amory Lovins, who is a good deal smarter technically than Rifkin and who should have been following LENR and other emerging new energy technologies all along, simply wants the world to get along on less energy, not more. He revels in his deserved appellation, "Mr. Negawatt." Lovins has been one of the leading proponents



The Hypercar Revolution, a mock-up of a fuel cell-powered sport utility vehicle.

height of page A16, bannered "U.S. Will Give Cold Fusion Second Look, After 15 Years." MIT Prof. Peter Hagelstein was nicely quoted: "What's on the table is a fairly straightforward question, is there science here or not?. . .Most fundamental to this is to get the taint associated with the field hopefully removed." Plasma fusion physicist Dr. Stewart C. Prager at the University of Wisconsin had this to say to Chang: "I'm surprised. . .I thought most of the cold fusion effort had phased out. I'm just not aware of any physics results that motivated this." Hah! I had given a heads-up to *The New York Times* on this story the week before, and was also quoted: "I am absolutely delighted that the D.O.E. is finally going to do the right thing. . .There can be no other conclusion than a major new window has opened on physics."

Other articles quickly appeared in the UPI wire service (Charles Choi, April 2, 2004), the *Salt Lake Tribune*, and Utah's *Deseret News*. Dr. Edmund Storms was quoted by UPI: "Finally, after years of actively stopping such research on the subject, a few brave souls in the organization (in DOE) are starting a process that should have been undertaken years ago. . .At the very least, a safe and inexpensive source of energy will be created that will change society in ways that are hard to imagine. At the very least, the damage caused by pollution and the brakes on development caused by a dwindling oil supply will be problems of the past."

Soon, it will be impossible for any credible journalistic source—especially one with specialized coverage of science—to ignore the story of the DOE reversal. Just as we had predicted these many long years, such a DOE reversal would give reluctant journalists "permission"—and a news peg—to renew their coverage of cold fusion. The floodgates have opened.

The Last Hurrah for the Pathological Skeptics?

While some have recommended that the much abused LENR field should now try to act charitably toward the pathological skeptics, who have so infuriated us for almost fifteen years, it is tough to feel sympathy for them, even as they seem to be facing an extremely embarrassing defeat. But we need to remind everyone that their nefarious purposes drive them to continue to be engaged in misinformation and attempts to derail honest investigation by DOE or anyone else. Here then is a modest gathering of the skeptics' howlings over the past few weeks:

❑ Princeton University physicist William Happer (a hot fusioneer and former DOE ERAB Cold Fusion report panelist in 1989): "I think a review is a waste of time. . .But if you put together a credible committee, you can try to put the issue to bed for some time. It will come back. The believers never stop believing." (*Physics Today*, April 2004)

❑ University of Texas at Austin chemist Allen Bard: "If they are saying 'We are now able to reproduce our results,' that's not good enough. But if they are saying, 'We are getting ten times as much heat out now, and we understand things,' that would be interesting. I don't see anything wrong with giving these people a new hearing." (*Physics Today*, April 2004)

❑ University of Maryland physicist Robert Park, the *de facto* spokesman of the APS: "I look over the stuff that has come out, and it looks like the same old thing. . .Some people say they see extra energy, some say they don't. I'm not optimistic they're going to come up with more discoveries." (UPI, April 2, 2004) This was followed by a rather meek and uncharacteristic (for Park) statement: "The way the system is supposed to work is that everybody is supposed to make their point, that science is not closed." But in his "What's New" column on the APS.org website on April 2, 2004, he was his old self:

> 1. COLD FUSION: TRUE BELIEVERS SEE DOE REVIEW AS "VINDICATION."
> There hasn't been much to celebrate in the fifteen years since the University of Utah held a press conference in Salt Lake City to announce the discovery of "cold fusion." Although a brave little band of true believers continued to trumpet cold fusion, the band leader was publishing *Infinite Energy* Magazine. That made it pretty hard to take this stuff seriously. Although there was no press release or announcement, DOE has apparently agreed to take a second look. That's not really too surprising; not since the Reagan administration has unbridled technological optimism so dominated Washington decision making: missile defense, hydrogen cars, hafnium bombs, manned missions to Mars. How are these other ventures doing? Let's take a look at one. . .[*IE* Editor's comment: What a great honor to have been attacked by this simpleton on so many occasions since 1991! And to think that it has led to free publicity too.]

❑ Caltech physics professor Steven Koonin (another original ERAB panel member from 1989): "Nobody is smart enough to say it is absolutely impossible, but extraordinary claims demand a very high standard of proof. . ." (*Physics Today*, April 2004)

❑ Dr. John Huizenga, now in retirement in North Carolina, but the head of the 1989 ERAB Cold Fusion panel: ". . .it's been laid to rest, and I don't see why they're looking at it again. . .We looked into the subject very thoroughly. I don't think much will come of it (the pending review). . .(it's) rather worthless to continue plowing that ground. . .there have been no positive results that have come along since then which were worthy of establishing another committee. . .(excess heat of the Fleischmann-Pons level) would produce an equivalent amount of fusion products (such as neutrons) and those fusion products should be very easy to see. And we do not see them. The Pons and Fleischmann announcement was 'outlandish'—quite different from that of Jones. . .Jones and company are 'working near the background'. . .It's very difficult to say one way or another. . ." (*Deseret News*, Salt Lake City, March 31, 2004)

Because this is a very fast-moving story, we will make every effort to post new developments about the DOE review on our website. Stay tuned for an exciting adventure. Paradigm shift happens.

"Can't Park" by Ragnar Yri, inspired by Robert Park's "What's New" column of April 2, 2004.

1989. Prof. Hagelstein chaired ICCF10, the Tenth International Conference on Cold Fusion, which was held in Cambridge, Massachusetts and in part at MIT, August 24-29, 2003. Solid demonstrations of excess power in electrolytic cells were exhibited on the MIT campus by two scientific groups (both of which, we should note, subsequently received research grants from New Energy Foundation). It was shortly after ICCF10 that Prof. Hagelstein wrote to Spencer Abraham. New Energy Foundation's *Infinite Energy* magazine decided to publish Hagelstein's letter in its November/December 2003 issue (#52, p. 46).

Prof. Hagelstein told the U.S. Secretary of Energy that *Wall Street Journal* reporter Sharon Begley, who had attended ICCF10 for a few days, concluded in her "Science Journal" column of September 5, 2003, "that perhaps most problematic about the conference was not what was presented and discussed at the conference, but the lack of interest on the part of the scientific community." The Begley column was titled: "Cold Fusion Isn't Dead, It's Just Withering from Scientific Neglect." The door to the DOE was evidently further opened by Randall Hekman, who is an MIT graduate, a former judge, and an energy entrepreneur (Hekman Industries). Hekman knows Spencer Abraham and Republican Congressman Vern Ehlers from Michigan, who is a physicist. Ehlers is quoted in the *Physics Today* article as saying that it is time for a new review, "because there is enough work going on and some of the scientists in the area are from respected institutions."

One potential minefield for an honest review of the LENR evidence, apart from the bias and well known hostility of the pathological skeptics, is the raising of the perennial straw man of an alleged "requirement" for a comprehensive microphysical explanation of LENR phenomena before the experimental data can be accepted. That is an anti-scientific tactic that the pathological skeptics have employed for years. There have been many proposed theories to explain the evidence—both the excess heat and the nuclear products—but no single theory appears yet to encompass all the evidence. That is not an unusual condition on the frontiers of physics and science in general, which the critics pretend to forget. So, our strongest advice for a fundamental ground rule for a *fair* DOE review is that it should focus primarily on determining this key finding: the validity of the evidence for non-chemical magnitude excess heat and nuclear anomalies—as well as any other physical anomalies associated with the systems, such as anomalies in light emission. Involved judgments about how the verified phenomena operate should be reserved for the future.

In May 1991, this author wrote in *Fire from Ice: Searching for the Truth Behind the Cold Fusion Furor* (John Wiley & Sons—now available through *Infinite Energy*): "After reviewing mounting evidence from cold fusion experiments, I am persuaded that it provides a *compelling* indication that a new kind of nuclear process is at work. I would say that the evidence is *overwhelmingly* compelling that cold fusion is a real, new nuclear process capable of significant excess power generation. . .There is yet no *proved* nuclear explanation for the excess heat. That excess heat *exists* is amply proved."

This conclusion of 1991, in the first book in the world to present a positive evaluation of the discovery, was based on already very, very solid evidence. Now the DOE review panel has much more evidence to back up that same conclusion. It remains valid in 2004 as it was in 1991. First time readers of *Infinite Energy* should be aware that another excellent book, which reviews the entire cold fusion saga up to the current era, is by MIT-trained engineer Charles Beaudette, *Excess Heat: Why Cold Fusion Research Prevailed* (2002 edition, available at www.infinite-energy.com).

It is the view of this author (perhaps not shared by many in the LENR field) that the DOE review, at least as part of its task, should examine other significant new energy-related research that has been published, beyond what is ordinarily confined within the LENR field (www.lenr-canr.org). This research is almost certain to shed significant light on what has been found within LENR proper; relevant links to this work and discussions about it are readily accessible on www.infinite-energy.com.

As an additional assist to the prospective DOE review, a Memorandum to the White House from this author (requested by President Clinton's staff in February 2000, following the urging of our supporter Sir Arthur C. Clarke) has been posted at www.infinite-energy.com. Review panelists and concerned citizens should examine this document. It provides a concise historical and technical overview of the scientific problem of energy from water titled, "The Strange Birth of the Water Fuel Age." Unfortunately, neither the Clinton Administration nor the present Bush Administration acted on the suggestions of this Memorandum, until the present impending review, which was separately prompted by Professor Hagelstein's letter. We sincerely praise U.S. Secretary of Energy Spencer Abraham for facilitating this landmark decision to launch a review.

Concerned citizens (and especially MIT graduates) should also examine the 55-page report about the events at MIT in the early days of the cold fusion controversy—a free downloadable pdf-file at www.infinite-energy.com.

Though we very much appreciate that the DOE will be carrying out a review of the LENR evidence, the field of New Energy does not need the DOE's imprint and approval (bear in mind, we may still not get it!) to realize that we are dealing with a critical frontier of scientific and technological research that has been validated long ago. Funding for New Energy research is needed *now*, not in nine or ten months. The DOE review is in some sense at best a corrective to a severe "political problem" that has occurred within the house of official science and in mainstream scientific publication. Therefore, we urge readers of this message to consider charitable contributions to the New Energy Foundation (a nonprofit 501(c)(3) corporation). These contributions already have made possible scientific research grants to New Energy investigators—especially within LENR, as well as ongoing scientific publication efforts: an international magazine, books, video tapes, DVDs, etc. For example, New Energy Foundation helped fund the ICCF10 conference in Cambridge, Massachusetts last August, which helped lead to the DOE review breakthrough. ICCF11, which will be in Marseilles, France from October 31 to November 5, 2004 (www.iccf11.org), is also in need of further financial support from New Energy Foundation (we have provided some funding already).

Press Coverage of the DOE Reversal

The news of the DOE reversal has been swift and much appreciated. Kenneth Chang of *The New York Times* wrote a fine piece on March 25, 2004, a full column extending the

should, by right, be compelled to examine all of this in its review. This review should have happened over a decade ago, but better late than never. The body of supporting evidence for large magnitude excess heat and nuclear products in "cold fusion" is now so solid at this time that it would be essentially intellectually impossible for an objective DOE panel to come to other than a very positive conclusion about the evidence. The potential for technological applications would be a logical inference from such a result. Of course, it is quite possible that bureaucratic, unethical machinations will again come into play that will preclude such a reasonable outcome. We will be watching this very closely.

Another difference between now and 1989: There are now *operational* experimental electrolytic and other excess energy cells in various laboratories in the U.S. and abroad; these are producing repeatable, verifiable excess energy that cannot possibly be explained by ordinary chemical reactions. In some cases, for example, one watt of electrical input power goes into a closed cell and an output power of 3 to 4 watts of heat occurs for a prolonged time (*e.g.*, the work of Dr. Mitchell R. Swartz in Massachusetts, who demonstrated active excess heat-producing electrochemical cells at MIT during ICCF10 last August). And, much more powerful cells have also been operated. There is evidence of helium-4 and helium-3 production, tritium production, low-level neutron emissions, charged particles, light emission spectral anomalies (*e.g.*, the work at BlackLight Power Corporation in New Jersey; albeit that company rejects direct association with LENR), the formation of unusual chemical compounds, and even the transmutation of heavy elements in what seems to be a mix of fusion- and fission-like reactions. Laser radiation, ultrasonic activation, and magnetic fields, among a variety of other stimuli, have been found to enhance LENR reactions. It appears that an entirely new realm of physics and chemistry is suggested by the expanding body of experimental evidence. There are almost certainly implications for biology and medicine too. Many of the scientific papers from the LENR field and other historical materials can now be freely downloaded from the websites: www.lenr-canr.org and from www.infinite-energy.com.

Confirming the Review

The confirmation of the DOE review came first in a draft article by *Physics Today* science journalist Toni Feder, which was targeted for that journal's April 2004 issue. This draft was circulated to several LENR scientists, critics, and others, who gave input to Ms. Feder. New Energy Foundation provided input too and welcomed the completely unexpected receipt of the draft article from her on March 3. The short, historic e-mail note from this science journalist, who happens to hold a physics Ph.D., reads:

> Dear Sources for this story:
>
> Below is a draft of my story on cold fusion researchers' attempts to have a new review carried out. Whether or not I have quoted you, I would appreciate your checking the draft for accuracy. Please also tell me if you feel I have left out anything crucial.
>
> I need to have your comments by Friday, 5 March.
>
> Thank you very much for your help.
>
> Best regards,
> Toni Feder, *Physics Today*, Austin, Texas

Though not satisfied with her article in every particular, this editor did praise Ms. Feder's account and gave her some critical feedback, as I am sure others did too. But the main reason for my elation was that the story confirmed what had until then been only a rumor. In the piece, deputy director of the DOE's Office of Science, James Decker, was quoted affirmatively: "I have committed to doing a review of cold fusion. . .(late last year) some scientists came and talked to me and asked if we would do some kind of review of the research that has been done. . .There may be some interesting science here. . .Whether or not it has applications to the energy business is clearly unknown at this point, but you need to sort out the science before you think about applications." The scientists who had met with James Decker (on November 6, 2003) were MIT Prof. Peter Hagelstein, Dr. Michael McKubre of SRI International, and Dr. David Nagel of Georgetown University (who formerly managed cold fusion research at the Naval Research Laboratory). The article duly appeared in *Physics Today's* April 2004 issue, which came out in the first week of April; it is now posted on the *Physics Today* website; in fact, it appeared on April 1, but it was thankfully no April Fools Day prank! It is now at:

http://www.physicstoday.org/vol-57/iss-4/p27.html

Physics Today is published by the American Physical Society, an organization which by-and-large has never been open to the study of LENR phenomena, though to its credit it has allowed small sessions on the subject to be organized at its national meetings. In fact, the late LENR theorist, Nobel laureate Julian Schwinger, resigned from the APS in the early 1990s because the APS journals refused to publish his theories about the possible mechanisms of cold fusion.

The first popular journal to publish the news of the impending DOE review was, however, the UK-based *New Scientist*. In its March 20, 2004 issue, freelance New Hampshire-based journalist Ben Daviss reported in a short article in the "Upfront: News in Perspective" section (p. 6) that James Decker, deputy director of the DOE's Office of Science, "has pledged to review evidence from the past fifteen years of research in the controversial field." Daviss also wrote, "The study could be completed by January 2005 and might open up the possibility of funding for cold fusion research projects."

There is additional high-level scientific support for the DOE review: Former DOE Office of Science Director, Dr. Mildred Dresselhaus (an MIT professor of electrical engineering and computer science) is quoted in the *Physics Today* article: "I think scientists should be open-minded. Historically, many things get overturned with time." Prof. Dresselhaus was on the original ERAB (Energy Research Advisory Board) Cold Fusion Panel in 1989, which rendered a highly negative and very premature report on November 1, 1989. Though over the years she has not been one of the highly antagonistic critics of LENR with which that panel was packed, she did not assist approaches to the DOE for LENR reconsideration during her brief position at the DOE in the Clinton Administration. This is a welcome turnaround for MIT Prof. Dresselhaus, for which we commend her.

MIT Professor Peter Hagelstein.

The initiative that helped launch the impending review was a letter to U.S. Energy Secretary Spencer Abraham from MIT Prof. Peter Hagelstein, a cold fusion theorist since

U.S. Department of Energy Commits to Re-examine "Cold Fusion"—15 Years of Evidence for Excess Heat and Low-Energy Nuclear Reactions

Eugene F. Mallove

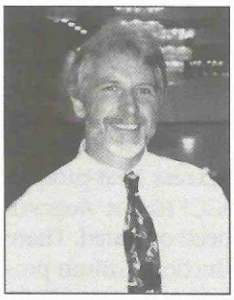
In an astonishing reversal of its resolutely negative policy, the U.S. Department of Energy (DOE) has confirmed that it will soon begin to conduct a review of the past fifteen years of experimental evidence for highly anomalous excess heat and low-energy nuclear reactions (LENR) in hydrogen systems. These two classes of phenomena attend the mysterious category of experimental results (and associated theorizing) that in 1989 came to be known as "cold fusion." This long-overdue re-examination of the beleaguered field of LENR, if conducted objectively and ethically (a very big *if*, of course), could result in a major upheaval in the scientific world for two fundamental reasons. First: The evidence for the class of LENR phenomena is now overwhelming in hundreds of bullet-proof technical papers, and it would be intellectual dishonesty of the highest order to dismiss all this evidence—as it has been for fifteen years—as misguided "pathological science." Second: There is overwhelming proof of the grotesque malfeasance of the Scientific Establishment in mocking, marginalizing, and censoring from its major archival journals legitimate scientific research from the LENR field. It is a case study of a government/academia-backed assault on a scientific discovery of overarching importance, which also has profound technological, social, environmental, and geopolitical implications. It is not the first time such a disgrace has happened, and, sad to say, it may well not be the last. But it is, to be sure, one of the biggest temporary miscarriages of science in history.

So, it is not only the validation of the phenomena that is at stake, it is fundamentally the credibility of the entire body of official science—its paradigms and its policies. Let there be no mistake: The reason for the intense opposition to this now unstoppable review—obstructionism that is already marshalling—is the audit trail of culpability for the disaster perpetrated by the DOE in its rush to a negative judgment in 1989. Finally, everyone should begin to understand that a Copernican-like upheaval may well be in the offing—the inevitable forced admission by the Scientific Establishment that element transmutation "in the cold" (at low-energy), *i.e.* modern alchemy, is for real and always has been. Low-energy transmutation phenomena have been confirmed in the laboratory, but there is evidence already that these potentially occur throughout nature. If this latter finding is ultimately proved, there could be massive collateral damage to a large number of self-satisfied scientific paradigms, ranging from biology to cosmology. The intensity of the opposition to this new revolution-in-progress will be no less than it was in the early seventeenth century.

The Timing of the Reversal

News of the DOE policy reversal came just as the fifteenth anniversary of the announcement of "cold fusion" at the University of Utah (March 23, 1989) approached. But the seeds of the sea-state change came about from events surrounding the 10th International Conference on Cold Fusion (ICCF10) late last August, in Cambridge, Massachusetts.

Exciting news had been circulating for about a month in the low-energy nuclear reactions field prior to March 23, 2004. Rumors were flying that someone in the DOE had agreed to allow a review of the entire "cold fusion" (LENR) question. The U.S. Department of Energy was, indeed, about to give public notice of a startling reversal of its past refusal to evaluate, with a fresh look, the large body of experimental evidence that now supports highly anomalous non-chemical magnitude excess heat phenomena in some hydrogen systems, plus associated nuclear anomalies. The details of how the review will ultimately be conducted, and when exactly it is to begin, have not yet been released formally, but most reports suggest that the appraisal will be completed by January 2005. On the other hand, Dr. Michael McKubre was quoted in a UPI article on April 2, 2004: ". . .it seems to be acted on in the Department of Energy at lightening speed. My guess is it could be done by the end of the academic summer" [*i.e.* by September 2004].



Dr. Michael McKubre of SRI International.

News of this major DOE reversal comes at a time of growing concern about present and future energy resources, as well as debate over funding for controlled thermonuclear fusion research, that is, "hot" fusion; for example, in what country should the infamous multi-billion dollar ITER (International Thermonuclear Experimental Reactor) be placed? It also comes when much discussion of the "hydrogen economy" and fuel cells fills the media. LENR research suggests, by contrast, that orders-of-magnitude more powerful energy reserves are associated with hydrogen reactions than conventionally understood chemical energy models would allow—thus making investments in hydrogen fuel cell technology far more shaky than its well-intentioned proponents may have imagined. The prospect of thousands to millions of times more energy release from hydrogen than conventional chemical theory would sanction ought to please open-minded environmentalists and others concerned about the future of the energy-environment problem and potential impacts on global climate. But if the past is any guide, such people will not necessarily be very supportive. Radically new forms of energy that could usher in a technological revolution of unprecedented magnitude are not necessarily welcome in certain quasi-Luddite circles.

Just as after the original announcements by chemists Drs. Martin Fleischmann and B. Stanley Pons at the University of Utah on March 23, 1989 and by physicist Steven E. Jones at Brigham Young University subsequently, the disclosure of the new policy by the DOE is certain to prompt intense controversy and expectation. The great difference this time, however, is that a much larger body of excellent published experimental work now exists from researchers around the globe. The DOE

that with the DOE turn-around, "vindication" has already arrived, which it hasn't. That *external* vindication can only be said to have come when there is broad-based recognition of the proved reality of the newly discovered phenomena—by the scientific community, by educators, by the press, and even by that quirky barometer of popular culture, the entertainment industry. Above all, vindication will have arrived in force when the everyday assumptions shared by people everywhere are changed, when they can confidently look forward to a day—one hopes not far off—when New Energy, in whatever form, will become a practical utility in their lives.

Of course, *scientific* vindication came long ago, simply from the preponderance of replicated results, which proved that LENR phenomena were not an illusory class of observations.

Let me share with you some of the good tidings that we have received in recent weeks, which I take as having been dispatched not just to me personally—though that's how they were addressed—or to *Infinite Energy*, but to the entire LENR community:

❑ What great news!!! Here I was beginning to think that physics would make no further progress until nature took its inevitable course, and the current generation of naysayers went to their just rewards for their outstanding contributions to humanity. . .Keep up your relentless work, and best of luck on the current reversal of fortune. —Steve R. O'Donnell

❑ The impending review is very good news indeed. I remember that when you visited Philadelphia, and we were chatting at the airport waiting for your plane to depart, that I asked you what you sought: in one word, it was "Vindication." I wish you well, and view your long struggle with respect and understanding. So now here are my continued and renewed good wishes that vindication shall be yours, along with all the others who have kept the faith all these years. —Mike Carrell

❑ So, we only wasted fifteen years? I guess better late than never. —Camille Grosdidier, VOA French

❑ Thanks, Gene. . .keep chugging. . .this train is seeing light, I think. —Vince Golubic

❑ Thank you for sharing this! It certainly sounds encouraging and hopeful; you know your time will come—this is all just a huge test of your patience! —Lisa Zakar

❑ C'est marvelliuex! I have forwarded your e-mail around! Momentum rolls along. Keep working on this vital project. —Pamela Munro

One of my greatest pleasures in recent weeks was to be quoted, again, in a *New York Times* article. Bill Broad had quoted me in 1991 and again in 1999. The present article announced the DOE turn-around (March 25, 2004, by Kenneth Chang, p. A16): "'I am absolutely delighted that the D.O.E. is finally going to do the right thing,' Dr. Eugene F. Mallove, editor of *Infinite Energy* magazine said. 'There can be no other conclusion than a major new window has opened on physics.'" It was very pleasing to be able to voice my opinion in the "newspaper of record." A surprising and welcome outcome of that citation: an executive with an oil investment firm contacted New Energy Foundation and gave an immediate, generous contribution. He wrote, "Didn't know you [meaning cold fusion] were still around. Sorry for not being a donor sooner. You can count on my support monthly." Now if that isn't a sign of something like a "Great Turn-Around," I don't know what is.

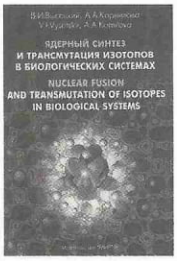
Even old Bob Park of the American Physical Society seemed to sense, grudgingly, that something Very Big was beginning to happen. He mentioned cold fusion "vindication" as the lead item in his "What's New" internet column of April 2, even though no one that I know from LENR was publicly using that term:

> COLD FUSION: TRUE BELIEVERS SEE DOE REVIEW AS "VINDICATION."
> There hasn't been much to celebrate in the fifteen years since the University of Utah held a press conference in Salt Lake City to announce the discovery of "cold fusion." Although a brave little band of true believers continued to trumpet cold fusion, the band leader was publishing *Infinite Energy* Magazine. That made it pretty hard to take this stuff seriously. Although there was no press release or announcement, DOE has apparently agreed to take a second look.

Sometimes even an insult can be an honor, when it comes from such an eternally misguided person. Poor Bob was probably most upset that the *New York Times* quoted this "band leader" and an out-to-lunch hot fusion physicist, and not him.

Other thoughts swirl like a hurricane around this still incomplete but emerging vindication. Why does it have to take so long? Why did this new science have to be so brutally victimized, and its researchers put through such prolonged abuse—just because they happened to make truly novel scientific findings? How many more months or years will the torment last? Will enough resources materialize in the near term so that work can really accelerate with or without DOE-provided funding? Furthermore, when will the LENR field itself realize that its findings are really part of a much larger problem that burdens modern physics: serious unrecognized foundational errors in its theories, which may make these theories unsuitable to provide a complete understanding of the LENR enigmas?

What will happen to tokamak hot fusion—will the DOE really be forced to see the light and get rid of that preposterous white elephant? Will the initial shock troops against cold fusion from MIT, Caltech, and elsewhere be exposed for their misdeeds? How will the pathological skeptics attempt to re-write the history of the past fifteen years to suit their malign purposes? The coming months will be very interesting times, that is for sure. Let's hope for some satisfying answers to these many questions. For now, let's just relax and try to think pleasant thoughts about the coming New Energy Age. It may be a bit closer than we had thought a few months ago.



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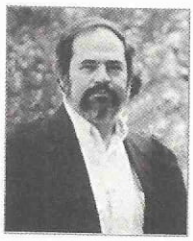
BREAKING THROUGH



Vindication!?

by Eugene F. Mallove, Sc.D.

News of the U.S. Department of Energy's recent commitment to review the past fifteen years of evidence for low-energy nuclear reactions (LENR) and associated excess heat phenomena has hit like a bombshell. It is almost like waking up, as many of us did, to find that Communism had toppled in Russia and that the Soviet Union was no more! So entrenched was the opposition at DOE and in academia against even publicly *reviewing* the LENR evidence (let alone accepting its stark implications), that many of us probably despaired that we would ever live to see the day of this turn-around. It is a truly astonishing reversal.

The details of how this DOE change came about appear in an accompanying article, "U.S. Department of Energy Commits to Re-examine 'Cold Fusion'—15 Years of Evidence for Excess Heat and Low-Energy Nuclear Reactions" (p. 9). But let's not get too carried away so that we ignore the implicit dangers of this review. We are not yet home-free at last, because there can be no doubt that just as in 1989, the pathological skeptics will be out in force with sharpened knives and all manner of dirty tricks to derail this review. They will try their best to kill it or make it much less than what it should be: A complete and unconditional acknowledgement that the DOE missed something very, very big beginning in 1989—two irrefutable classes of phenomena that are obviously related at some still not fully understood fundamental level: 1. Large magnitude excess energy far exceeding any conventional chemical explanation, in a variety of electrochemical and gaseous hydrogen-containing systems, and 2. An array of *nuclear* changes and emissions in what were previously thought to be purely *chemically* active systems containing hydrogen.

There is yet no public information available about just how this review is to be conducted, but that is not surprising. Also, the DOE has not trumpeted the review with a public press release. Perhaps this is its way of sneaking off like a defeated dog with its tail between its legs. A more sinister interpretation, which I do not think likely to be true, is that the pending review is actually a ruse to entrap the LENR community and then attempt to kill this work off once and for all. That could be attempted, of course, by insisting that an integrated theory for *all* of the claimed LENR effects be presented before the DOE will "bless" the field with a positive report. No such satisfactory, comprehensive theory exists in the LENR community, nor is one likely to be framed in the next few years. But theory-driven optimism is rampant in the LENR field, so there is a real danger that one or more theorists will try to push their theory too far and will put the field in a position from which it would be difficult to recover, by handing the opposition another straw man that could be shot down.

To gauge the coming perils, consider the statements of one of the most vindictive and vicious LENR critics, Prof. William Happer of Princeton. This unrepentant person is still mouthing his ignorance. The hot fusioneer and former DOE Energy Research Advisory Board (ERAB) Cold Fusion Report panelist in 1989 is quoted in the April 2004 issue of *Physics Today*: "I think a review is a waste of time. . .But if you put together a credible committee, you can try to put the issue to bed for some time. It will come back. The believers never stop believing." In other words, Happer "knows" *a priori* that there is no science here, that the research must all be based on "belief." What a contemptible villain!

And note well Happer's assumption that the DOE review will inevitably draw a negative conclusion—a preordained result. Though Happer has not heretofore examined LENR papers objectively—or most likely even read them—he confidently wears his well-known bigotry on his sleeve. This is the man who concluded that Drs. Fleischmann and Pons were "incompetent boobs," simply by watching them on television in 1989. Don't think for one minute that Happer will not actively work toward the obfuscation of even a mildly supportive report that the DOE might wish to issue. People like Happer are, in a peculiar way, as dastardly as terrorists who hijack airplanes. The Happers of this world are always plotting to hijack science and kill ideas that could benefit civilization, simply because of their irresponsible fanaticism in defending shaky scientific turf.

The virtue of the DOE review process that has now been promised is that it brings the topic out into the open again; it gives the LENR research community a chance to contrast its solid evidentiary record with the irrational concepts and nonexistent rationales of the pathological skeptics. It also allows the vast audience of potential good will that exists for "cold fusion" to become engaged and focussed again. It gives journalists "permission"—the all-important news peg (the DOE review as a hard news item)—to write about cold fusion again. Just as we had long predicted and therefore struggled to achieve, there has been an outpouring of general media articles about the DOE review. This is exciting news for young journalists, who may not even have been very aware of cold fusion, simply because they were too young when the story first appeared.

The entire LENR research community and interested supporters of that research, not just the heroic participants who solicited the review at DOE, deserve broad praise for helping to bring about this fantastically welcome change of heart. It is step one in our collective vindication. After putting out the news about the DOE reversal over e-mail, I have been impressed with many kind messages that have poured in from subscribers, acquaintances, and friends, who imagine

Catalanotti's group developed a titanium dioxide pigmented Tedlar film and carbon black pigmented Tedlar film which were laminated with the black side towards the object to be cooled and the white side towards the sky (the object otherwise in a styrofoam insulated box), and got temperature drops of 5°C during the day (in direct sunlight) and ~15°C at night, but not enough to get below freezing, so their sponsor pulled funding. I was able to get some of the titanium dioxide and carbon black pigmented Tedlar film from Dupont (they are commercially available), but time has not permitted me to laminate them and try to duplicate the University of Naples work.

The work by NRL was to try to power an aerostat (tethered blimp) for over the horizon radar work and power it using the selective surfaces and a thermoelectric array at night and solar cells during the day to save battery weight on the aerostat. I believe the final solution was very high voltage cables (minimizing conductor weight) to send power up the tether, but Lemley actually built two generations of his earth albedo reradiated heat energy conversion devices before his funding was cut. This whole area of tapping ambient energy flows has been of great interest to me for the past twenty years but after the spurt in research during the late 1970s I have seen nothing published since. Nothing has gone commercial even though the technology of these highly selective surfaces would seem to have myriad applications. Most solar collectors have gone to purely black body coatings with no wavelength selectivity.

Paradigm Shifts Needed

Recently I received a renewal form for my *Infinite Energy* subscription. I am hesitant to renew, but am doing so. I am hesitant not due to a lack of interest in the subject of excess/free energy or the quality of excellence of *Infinite Energy*, but because I understand 0.1% of the material presented. This is due to my ignorance of the mathematics of physics and engineering. My professional background is biology, microbiology, and environmental health. I am fascinated with the work you are achieving in leading the way to a major paradigm shift in the field of physics and engineering.

While teaching courses in environmental and international health at California State University, Chico, I pioneered and developed a course in alternative (complementary) medicine. Opposition was experienced from the medical, nursing, and biological fields. The course was attacked as "anti-science" and I was accused of teaching hokum. The course was vitally needed due to the confining restraints of the biomedical model and students needed to be exposed to and made aware of the basis and structure of different systems of healing, such as structural wholeness (*i.e.*, osteopathy, chiropractic, rolfing, etc.), acupuncture, homeopathy, and spiritual healing. As the course was being initiated in the mid-1970s, *The Structure of Scientific Revolutions* by Thomas Kuhn was raising questions about the restraints of scientific models held by traditional scientists when confronted with new knowledge and the need for change expressed by paradigm shifts. It appears that the bubble is about to burst in the field of physics and engineering.

I have been circulating the editorial, "Nikola Tesla: Man of Three Centuries" (*IE* #48), to people showing potential interest. It is readable. I am convinced that there are a large number of informed readers like myself who lack the exactness of mathematics who would show interest in excess/free energy if there was some way to convey the research results in more simplified language, but fully understand the need for *Infinite Energy* to maintain its professional competency among scientists. Perhaps there could be editorials published periodically like the Tesla one, or short, readable summaries of important research papers detailing progress in the field.

I would be interested in knowing what happened to the DeLorean automobile that was equipped with a power pack of twelve 12-volt batteries with a "recharging" device.

My best wishes for continued success.

Jules R. Vautrot
Chico, California

The Editor Replies: Thank you for highlighting several concerns that govern our own approach to publishing and explaining scientific material in *Infinite Energy*. We hope that readers understand, as you do, that *IE* must be a mixture of original scientific research and explanatory and motivating editorial material. It is not always straightforward to make some difficult scientific concepts accessible to lay audiences, but we try our best and will attempt to do more.

First, we extend our great appreciation for your continued support by having renewed your subscription. We thank you also for sharing your experience with establishment critics of your course on complementary medicine. Therein lies an additional compelling reason for continued monitoring of these pages. The field of New Energy is inextricably connected with alternative medicine, as you clearly have intuited and will learn more intimately in the coming months and years. At the very least, the obstructionist mentality against exploring the most radical—yet *real*—frontiers of medicine and biology is at work in the Establishment's assault against the new physics that underlies New Energy.

Alas, the episode with Mr. Tilley's claimed "recharging device" (see *IE* #45 and #46) has taken an all too familiar turn, with infighting among the purveyors of this claimed technology and a failure to publish definitive test results. Fortunately, there are many researchers who *are* doing so, which gives our field a very solid scientific footing. —*EFM*

The World Is Listening

I have just read the review of the Tenth International Conference on Cold Fusion by Eugene Mallove (posted at www.infinite-energy.com and also printed in *IE* #52) and was quite saddened by the tone, in particular the comment, "the world will not be listening." I agree that most people in the world will not know of continuing developments within LENR/CF, but this is largely due to the lack of coverage given by most scientific and serious press, as you well know. I suspect, however, as and when people find out that the majority of the Established Scientific Community has ignored this field despite evidence telling them they should not be ignoring it, they will feel angry like I do at their sheer complacency.

What I am really trying to say here is that, at least, someone like me, a non-scientist, is aware of the continuing work in this field and of the significant importance it has. I wish you all in the field of LENR/CF the success you so rightly deserve. So, at least, while most of the world is kept ignorant, some of us do, by our own endeavors, appreciate what you do and your continued commitment to keeping sites like *Infinite Energy's* going.

David Palmer
Somerset, England

reduced, because when I have observed it I have absorbed much tritium in titanium"; probably the important scientists at Los Alamos had the same opinion as Terry Buxton. I wrote to Dr. Buxton about this matter, but I didn't receive an answer. In the beginning of the section of my paper titled "Evaluation of the Experiments" (p. 14 of *IE* #54), I have clearly given the reason why the preparations of Terry Buxton cannot result in the decrease of tritium radioactivity: Small size, monocrystallinity, and perhaps arrangement in chains are necessary conditions for decrease of lambda (λ). The necessary conditions are surely not fulfilled with the Ti-preparations used by Terry Buxton. The Ti-preparations applied for storage of tritium consist of big non-monocrystalline particles (see Reference 7 of "Cold Fusion and Decrease of Tritium Radioactivity"). I enclose a copy of this paper ("A Suitable Tritium Carrier for Gas Discharge Tubes," *Proc. of the 2nd U.N. International Conference on the Peaceful Uses of Atomic Energy*, Vol. 31, pp. 360-362); it was the beginning of the story in 1958. Figure 2a shows an electron micrograph of the Ti particles, as used for storage of tritium. (These preparations were treated to obtain smaller particles.) They consist of big, non-monocrystalline and separated Ti-particles. Thus decrease of tritium radioactivity cannot occur with the preparations of Dr. Buxton.

Finally, I believe that the decrease of tritium radioactivity is definitely proved by my thermodynamic evaluation, as communicated in my *Infinite Energy* paper. If I have the opportunity, I will also communicate the procedure by which preparations with $\lambda = 0$ for tritium can be made. It is important for mankind to pursue this work and have an open mind.

Otto Reifenschweiler
Eindhoven, The Netherlands

✍ ✍ ✍

Physicists' Dilemma

Knowing that perpetual motion is impossible, physicists are now struggling to understand how it can be that a magnet can be caused to spin continuously for no apparent reason. See the February 2004 issue of the *American Journal of Physicists* where, on pages 243-248, two authors (M. Schreiner and Claudio Palmy) speculate as to the mystery energy source that powers what is now a demonstrable phenomenon.

The title of their paper is: "Why Does a Cylindrical Permanent Magnet Rotate When Levitated Above a Superconducting Plate?"

The abstract declares: "If the magnet has a cylindrical shape and is axially magnetized, it can start to oscillate along a horizontal axis with increasing amplitude and might eventually rotate continuously."

There is a little caution here, introduced by the word "might," no doubt to avoid raising the referees' eyebrows too far, but the message is that the magnet does rotate and the question is: Why?

They try to argue that maybe a temperature differential in the magnet plays a role in helping to set up a driving torque, but I see here evidence supporting a different proposition, namely that the oscillatory longitudinal motion of the magnet causes its magnetic flux to pulsate owing to linking with an induced reaction current in the superconducting plate. This is a recipe for setting up a radial electric field pulsation in the magnet, which has bearing upon the homopolar motor free energy theme, a process which can import energy steadily from the aether.

Apart from my article in this issue of *Infinite Energy*, entitled "The Physics of Perpetual Motion," I have just, before seeing the above-referenced paper, put an item entitled "Energy Science: An Introductory Overview," on my website www.aspden.org/books/Es/books/esbookoverview.pdf which quotes sixteen pieces of evidence in support of the general theme that setting up a pulsating radial electric field imports energy from the aether. I now see that I can add one more, making seventeen.

Harold Aspden
Southampton, England

✍ ✍ ✍

Anomalous Blackbody Radiators/Absorbers

There is a large body of information from the 1970s to 1980s about selective absorbers and radiators which appear to violate blackbody curves through the selective properties of various coatings and surface treatments. These include Agnihotri and Gupta's book *Solar Selective Surfaces*, 1981; the series of papers published by Catalanotti *et al.* at the University of Naples between 1975 and 1981 on radiative cooling from selective surfaces ("The Radiative Cooling of Selective Surfaces," *Solar Energy*, Vol. 17, 1975, pp. 83-89; "Nocturnal and Diurnal Performance of Selective Radiators," *Applied Energy*, Vol. 3, 1977, pp. 267-286; "Selective Covers for Natural Cooling Devices," *Il Nuovo Cimento*, Vol 1C, No. 5, September/October, 1978, pp. 419-429; "Selective Surfaces for Natural Cooling Devices," *Journal de Physique*, Vol. 42, January 1981, pp. 423-430); Lemley's work at NRL with selective absorbers and radiators ("A Radiation Thermoelectric Power Converter," *Proceedings of the Third International Conference on Thermoelectric Energy Conversion*, March 12-14, 1980), and Golli and Grenier's work along similar lines to Catalanotti's at the University of Monastir in Tunisia and the Observatory of Paris respectively ("The Inverse Greenhouse Effect: Application to a Solar Cell," *Journal de Physique*, Vol. 42, January 1981, pp. 431-436). They all showed that abrupt discontinuities in the emissivity/absorptivity curves can be accomplished (from 0.1 to 0.9 within a few tens of nanometers) in the near infrared to mid infrared range, allowing for cooling in direct sunlight or absorption of the reradiated heat of the earth for power conversion.

Temperature differentials obtained by all of these workers would easily run an MM6 Stirling engine. (I have one of these beautiful little machines as a science demonstrator for operation from heat from one's hand.) Thought this note might be helpful in furthering the cause of tapping ambient energy flows.

Phil Pesavento
Fairmont, West Virginia

The Editor Replies: Thank you very much for your very informative note. I did not know anything about this work. Did any of the investigators make remarks about possible Second Law violations? Did any of this work lead to anything of a practical nature that is in use today? —*EFM*

Pesavento Replies: None of the papers made any comments about Second Law violations. They all discussed that these coatings behaved somewhat like selective optical filters, but that they did not require the precise thickness or the multiple layers usually associated with interference filters. Even something like putting a sprayed transparent polymer coating on polished aluminum would result in large notches in its reflectivity spectrum.

The Catalanotti *et al.* work was sponsored by Montiedison, the Italian equivalent of Dupont, which was looking for a plastic sheet material which could be used as a passive refrigerator.

LETTERS TO THE EDITOR

Comments on Reifenschweiler

I just wanted to commend you for publishing the articles by Otto Reifenschweiler (*IE* #54). If this would have appeared in *Physical Review* it would have been next year; you did a good service by getting this paper to folks a lot earlier. It has astounding implications for nano-technology and condensed matter theory. Thanks!

V.F. Golubic
Allen, Texas

This is as good an occasion as any to congratulate *IE* for having had the courage to publish the Reifenschweiler papers. The papers do take a self-validating approach towards their conclusions, but there is no doubt in our minds that, barring a diffusion artifact, the experimental phenomenon is real and of great importance. The central questions are: what are the physics of the implicit process(es), and whether the observation does indeed have something to contribute to the achievement of table-top fusion.

We wonder why Reifenschweiler did not explore, or have the chance to explore, the second valley in the data. For the observed behavior suggests that there are at least three possible states of tritons, rather than two—as the author's hypothesis effectively proposes from analysis of only the first valley. The return of Bremsstrahlung to count-values characteristic of initial levels is also remarkable and it indicates that at least the first two states of tritons are wholly reversible. It also suggests that pair-destruction is not involved in the first transitions, even if no gamma-ray monitoring was performed—and this is in accord with the fact that tritium has no gamma decay.

We note in passing that the existence of three distinct triton states strongly resonates with our own work on positronium and the heterogeneity of tritium populations. Aetherometric analysis has identified three separate tritons (electron masses of 5498, 5496 and 5494), and the exact positronium structures that serve as their intranuclear glue (unpublished results). However, decays between such triton species would be marked by gamma radiation. Since tritium does not emit gamma radiation and Reifenschweiler's results suggest complete reversibility between the initial and the second states, the positronium glue must not be lost to tritium, *i.e.* to that 40% population that was observed to transit to a near-zero radiative state between, say, 150 and 300°C, and subsequently, with still higher temperatures, to revert to the initial radiative state. Accordingly, the explanation is likely the one suggested by Reifenschweiler, *i.e.* that there are unsuspected macromolecular states of tritium—in certain titanium lattices—which reduce radioactivity.

Our own suggestion is that, much like ordinary phase states of matter, these macromolecular states of tritium stabilize the nuclear glue of tritons and decrease the probability of their beta decay. But then, it would be unlikely that the key to table-top fusion would reside in a process that stabilizes tritium. Be this as it may, the observed effects of the thermal treatment effectively breaks down the dogma of stable and unchanging half-lives—by showing that nuclear processes can be modulated such that radioactive decay can be suspended, or blocked.

As the decay of a single radioisotope is a logarithmic function, the abscissa intercept of the straight line obtained when the log of successive counts is plotted against time permits determination of the fixed half-life of a population of radioactive atoms, as defined by the "length of time" during which their number is reduced by one-half. As Eugene Mallove's preface to the Reifenschweiler papers eloquently puts it, this rigid definition of a fixed half-life cannot permit sudden decreases and increases in the count rate of an emitter population that might be caused by chemical, thermal, electric, or still other physical factors. Indeed, it is a dogma that must go. It is, however, unlikely that a manipulation which suspends the physical processes of atomic disintegration responsible for an orderly or predictable half-life will actually reduce that half-life, which begins counting once the nuclei are again destabilized. Our own investigation of beta emitters has preliminarily identified near-reversible conditions that increase their radioactivity (unpublished results). In our opinion, it is more likely that effective alteration (specifically, shortening) of the half-life of beta-emitters for purposes of nuclear remediation will be achieved by processes that accelerate, rather than decelerate or suspend, the rate of radioactive decay.

Paulo Correa and Alexandra Correa
Concord, Ontario, Canada

"Radioactivity Reborn"

Dr. Mallove wrote an interesting and fine article, "Radioactivity Reborn" (*IE* #54, pp. 10-12), which accompanies my two articles about cold fusion and the decrease of tritium radioactivity. I thank Dr. Mallove very much for the fine work he has done about this matter. I had a short telephone conversation with Jed Rothwell of www.lenr-canr.org. He mentioned that Dr. Edmund Storms has some questions concerning my work. I see that Dr. Storms is retired from Los Alamos National Laboratory, so I can imagine the kind of questions he may have. It was in 1994 when Dr. Roger Close, from Sandia National Laboratory, wrote to me and asked to collaborate to perform preparations where tritium radioactivity was reduced. This was an important quality, because tritium was used in atomic weapons and it had to be regularly renewed because of radioactive decay. This costs a great amount of money.

A fine collaboration, mainly by fax and telephone, between Roger Close and myself followed. Roger built an excellent apparatus applying ultra-high vacuum technology and modern solid-state detectors. In the meantime, experiments were done at Sandia on gas evaporation of titanium. I have obtained electron micrographs of their preparations, which are very beautiful. In October 1995, I visited Sandia with a group from Dutch Television, which made a video for broadcasting in Holland.

The preparatory work was ready, but the apparatus had to be transferred to Los Alamos, because at Sandia there was no laboratory where one could work with tritium. Just at that time a chemist, Dr. Terry Buxton, arrived at Los Alamos in a management role. He said, "The radioactivity of tritium cannot be

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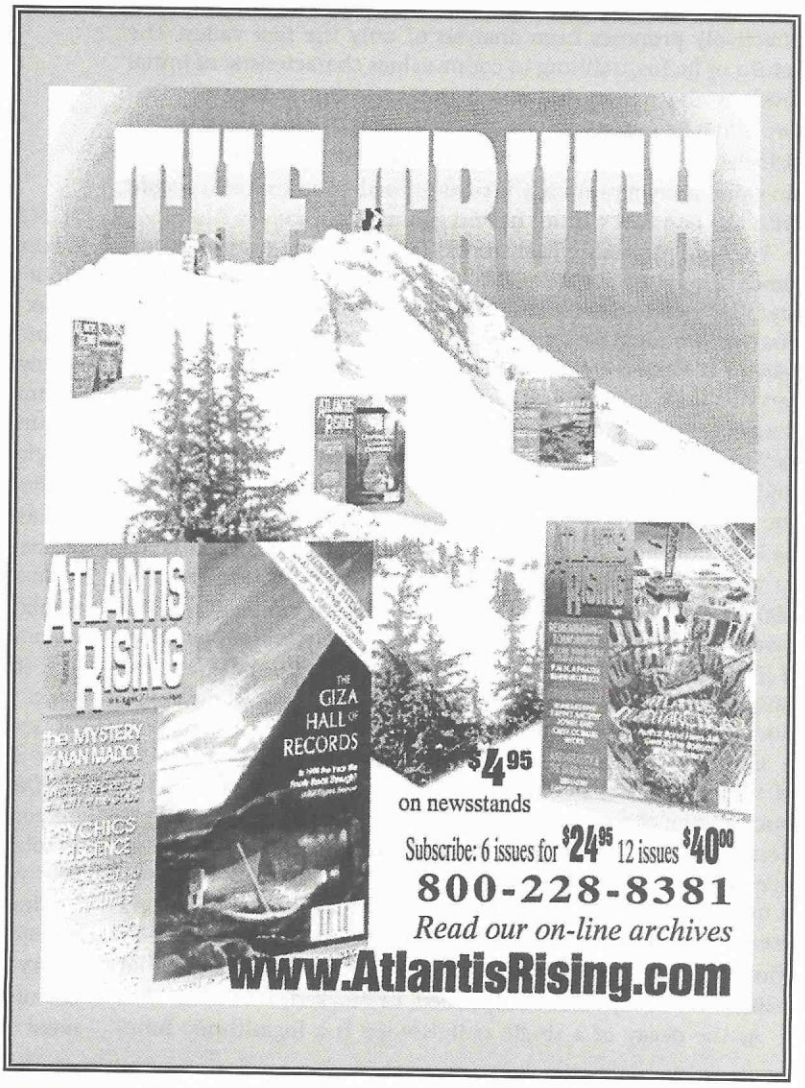

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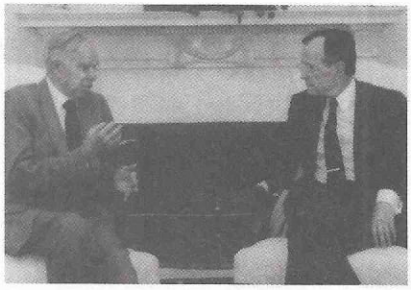

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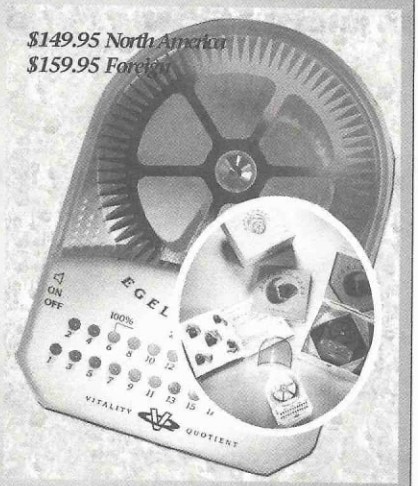

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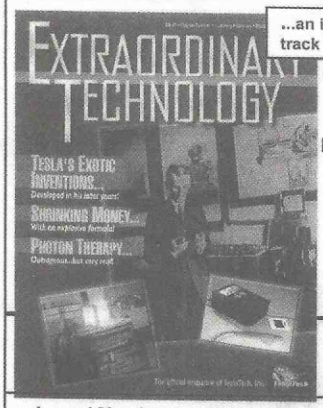

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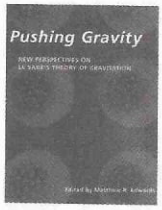

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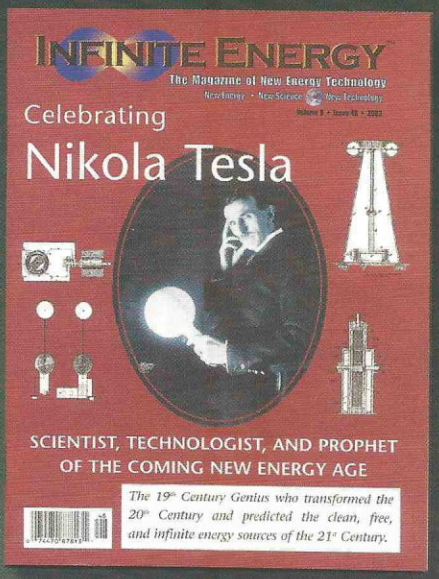

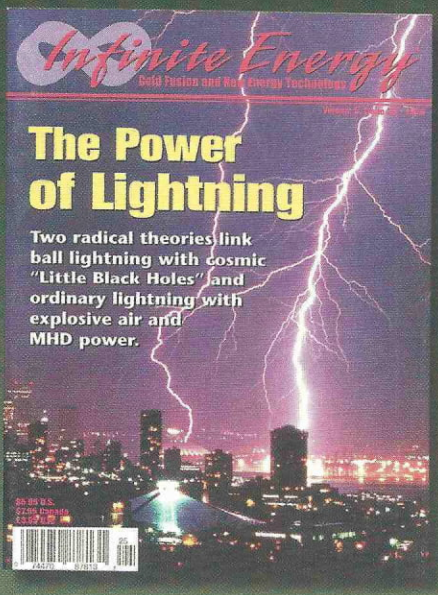

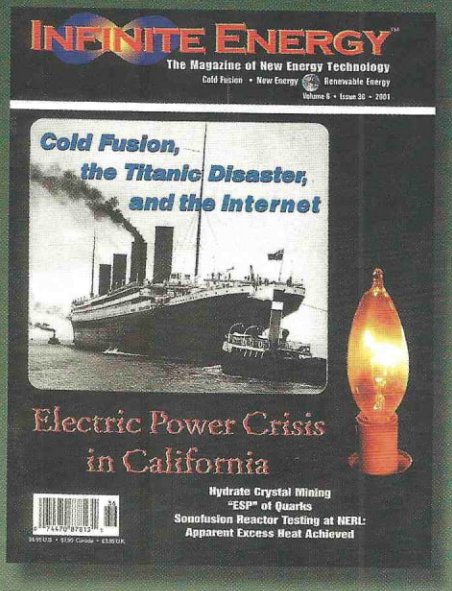

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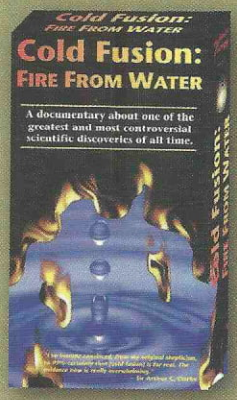

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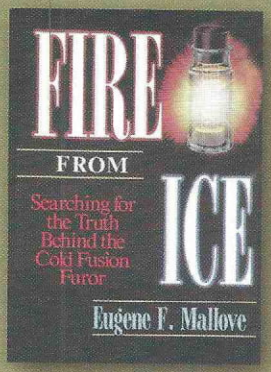

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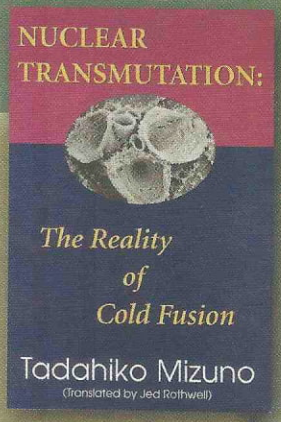

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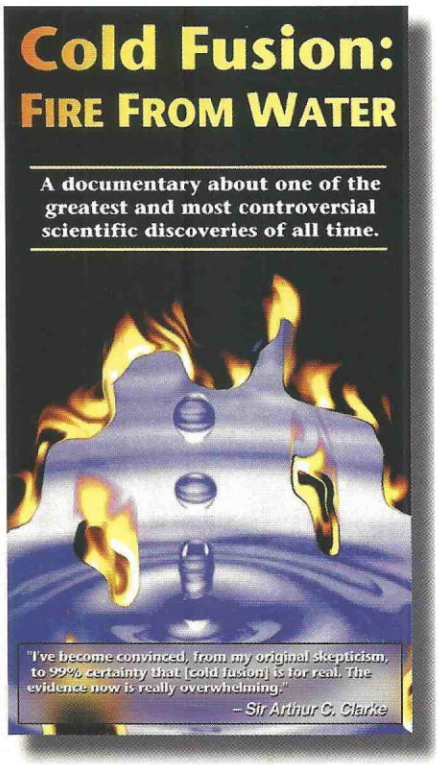

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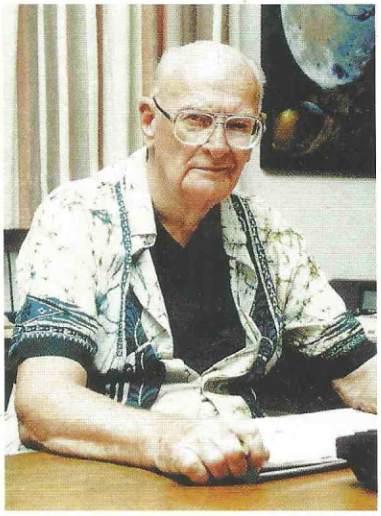

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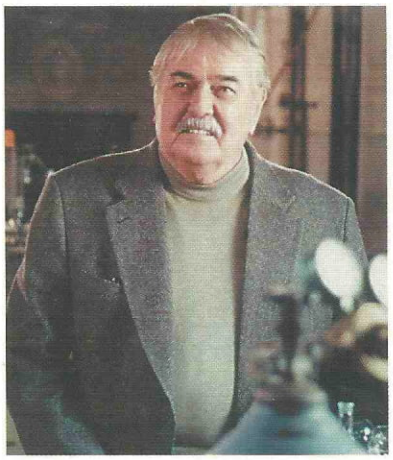

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